THE

ELECTRICAL REVIEW.

VOL. LXVI. MAY 27, 1910. No. 1,696.

ELECTRICAL REVIEW.

Vol. LXVI.] CONTENTS: May 27, 1910. [No. 1,696.

	Page
The Brussels Exhibition	849
Organised Electrical Manufacturers	850
Labour Conditions in Public Contracts	850
Electrical Financing Banks	851
A Darlington 500 KW. Exhaust Steam Turbine (*illus.*)	852
Debate on the Effects of Free Trade or Protection upon the Electrical Industry	853
The Difficulty of the Consulting Engineer	859
Correspondence:—	
The Whitehaven Colliery Disaster	859
A Unique Cable Joint (*illus.*)	860
The Election of Council of the I.E.E.	860
New Electrical Devices, Fittings and Plant (*illus.*)	861
New Institution of Civil Engineers' Building (*illus.*)	862
Legal	863
Business Notes	864
Notes	869
City Notes	871
Stocks and Shares	876
Market Quotations	876
Share List of Electrical Companies	877
Exports and Imports of Electrical Goods during April, 1910	879
The Loading of Telephone Cable Circuits (*illus.*) (*concluded*)	880
Proceedings of Institutions:—	
Depreciation	882
The Electrical Driving of a Lead Mill (*illus.*)	885
Methods of Governing Steam Turbines	886
Foreign and Colonial Tariffs on Electrical Goods	887
New Patents Applied For, 1910	888
Published Specifications	888
Contractors' Column — Advertisement pages xxiv, xxvi and xxviii	

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address.: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1910 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4 Ludgate Hill, London, E.C.

BRUSSELS EXHIBITION.

THE Exhibition which is now in progress at the Belgian capital affords, we believe, the first instance in which the British Government has exerted itself seriously with a view to ensuring the adequate representation of our national industries and art in a foreign country. It is true that on previous occasions the Government has appointed Royal Commissions and made grants in aid of exhibitors, but these have been sporadic efforts, each independent of its forerunners, and far from efficient in their operation, being unable to apply effectively the experience previously gained. In the present instance the new Exhibitions Branch of the Board of Trade has commenced operations, with a capable and energetic staff, and has succeeded already in effecting a vast improvement in the co-ordination of exhibits, the inducement of important firms to take part, and the elimination of unworthy examples of our products.

We do not suggest that the department has been entirely successful, or that the manner in which this country is represented is above criticism; indeed, at a later date we propose to offer certain criticisms regarding the British section of the Exhibition. But it must be remembered that the Exhibitions Branch was not organised early enough to secure the best possible results—it was only by the courtesy of the Belgian authorities that we were enabled to do as well as we have done—and that one ought not to expect the acme of efficiency to be attained at the very first attempt. The official intervention has not in every case received a hearty welcome from the exhibitors, being practically a new and untried factor in their calculations; but we have no doubt that their confidence will soon be gained by the new department, and we are convinced that it will exert a powerful influence in the future, tending towards the promotion of a more just and adequate appreciation of our national capabilities.

The British industrial section is admirably situated, right on the main route through the principal halls, and is equally well laid out; moreover, it is practically complete. The British machinery section is also well placed, occupying the middle third of the international section; but here, owing to causes beyond the control of the exhibitors, a great deal of work remains to be done in all quarters. One or two of the British stands are quite empty; on the other hand, the great majority of them are practically finished.

The French sections are perhaps the most backward in the whole exhibition, visitors not being admitted at all at present. The Italian section is not so much behind, but is still far from ready.

Need we say that the German section is complete in almost every respect? It is here that we find the triumph of organisation, efficiency and co-operation. The whole of the German show is housed in a separate building, erected on land which, we understand,

was purchased by the German authorities for the purpose, so that the section is, to a certain extent, free from the regulations imposed upon other national sections. Here will be found a remarkable display of goods, apparatus and machinery, undoubtedly the most ample, effective and representative in the exhibition, so far as one can judge at the present stage. We shall return to this subject later, as the limits of our space forbid our entering into detail here; but, in conclusion, we wish to draw attention to a very noteworthy fact—that heavy engineering exhibits are almost entirely absent. There are a few in the German section, notably a 10,000-K.V.A. turbo-alternator, a large shearing machine (electrically driven), weighing 170 tons, and two large "semi-portable" engines, one of the latter being rated at 1,000 H.P.; but the names of the great British and German companies are practically unrepresented, although Brussels is comparatively easy of access. (So, by the way, is Shepherd's Bush!)

In the course of, say, six weeks, the Brussels Exhibition will be ready for inspection; even now it is well worth a visit, but we do not advise anyone to make the journey for another month at least.

Organised Electrical Manufacturers.

THE useful work that has been done by the National Electrical Manufacturers' Association, Inc., has been so recently dilated upon in these columns that our readers hardly need to be reminded of it in detail here. But the possibilities that lie open to this organisation, as it becomes stronger and more representative of the whole industry, have been brought out rather prominently this week. We hope that by the co-operation of some who have formerly held aloof in the belief that the Association consisted of a clique, or that it was largely composed of gentlemen whose interests were not identical with those of British manufacturers, it will become strong enough to take full advantage of the opportunities that await a powerful manufacturers' organisation. If any association presents features or suspicions of cliqueism, these might be effectively overcome by a substantial increase in the membership. If it may have been once true, as some felt, that the importer was rather strong in the councils of the Association, it was due to the British manufacturers withholding their membership support. Whatever good the Association may have done, and we have shown that it has rendered real service along certain lines, has been done with the co-operation of importing firms, and has brought benefits to all manufacturers alike. This should be borne in mind in the future decisions of the body.

Two recent developments of the Association's work demand special mention just now. The debate opened on Monday last on fiscal policy and the electrical industry could not have been arranged on authoritative lines by any other existing organisation. The subject is not one for the Institution of Electrical Engineers, nor for any of the groups of sectional interests that exist among us, not even the newest and the most exclusive. The Manufacturers' Association is more the body of men to promote such a discussion, and if it were to organise other meetings for the discussion of vital matters that arise from time to time in connection with electrical trade and industry—subjects interesting to commercial men who are not inclined to gather together to hear a technical paper and discussion in other places, we are inclined to think that it would have a good deal of support. Without dwelling further upon that idea at the moment, let us proceed to refer to another evidence of greater activity on the part of the Association. We learn from Mr. Hawes, the Secretary, that a meeting was recently held in Manchester for the purpose of forming a Northern Section of this Association. There have been other attempts made in Manchester by the same organisation before it was regarded as it is now. We are glad to know that this latest meeting was well attended and that the formation of such a section was resolved upon. Mr. B. Longbottom was elected Honorary Secretary—what more energetic spirit on the committee could be found?—and as the outcome of the meeting a number of firms have since joined the Association, Messrs. E. Brook, Ltd., H. T. Boothroyd, Ltd., Clarke, Chapman & Co., Ltd., Evered & Co., Ltd., Liverpool Electric Cable Co., Ltd., Bertram Thomas, Mavor and Coulson, and Wright & Wood. We understand that several other firms agreed to join and have since sent in their applications. The result therefore of this meeting is that a strong section of this Association is now established, consisting of firms in the North of England, and it will deal directly with local matters.

We are informed that the strong feeling which was shown at this meeting that the Association should be more national in its character—as it always has been in its title—has led to a revision taking place in its by-laws, "so as to put the British manufacturers in their right positions." Perhaps we shall hear more concerning what that means at a later date.

Labour Conditions in Public Contracts.

THIS question is one that is ever with us, and time after time it has been discussed in one form or another in these columns. It is only right that public authorities should insist upon fair wages being paid and proper conditions of employment observed, and public opinion certainly sanctions the insertion of clauses to secure this end in municipal contracts.

It is, however, unfortunately true, that in some cases this feeling has been exploited by the organised bodies of workers to gain their own ends, with the result that many municipal contracts are loaded with so many labour conditions that their strict enforcement is practically impossible. The result is often just what might have been foreseen. Tenders are asked for certain goods or for a given work, and a number of firms make offers. The lowest tender is made either by an agent of a foreign firm or by an English firm who will purchase from abroad. This tender is not subject to the labour conditions, either because, on the one hand, there are no local Trade Unions to fix the rates, or, on the other, such conditions are not enforceable in foreign courts of law. The totals of the various offers are read out before the Council, and the lowest is accepted. It is not realised that in such cases an injustice has been done to those firms who tendered in accordance with the conditions, and that instead of benefiting the workers of this country, the insertion of the conditions combined with their subsequent practical repudiation has actually done them harm.

Our attention is recalled to this well-worn theme by the perusal of a new labour clause which has just been adopted by the Birmingham City Council for insertion in its contracts.

The Trades Council of that city asked the Council to insert a clause which embodied the following:—

(*a*) Only tenders to be accepted from, and contracts placed with, firms who regularly pay to their workpeople the standard rates of wages, and observe the hours and conditions of labour recognised by the local trade union, and who do not prohibit their employés from joining or continuing to be members of such union.

(*b*) All advertisements regarding contracts to make clear that these conditions are to be strictly observed.

(*c*) No transfer or sub-letting to take place without the consent of the Council, and then only on condition that the main contractor retains full responsibility for the observance by the sub-contractor of these conditions.

(*d*) Lists of all rates of wages paid in connection with work to be supplied to the Council, which list shall be open to the inspection of the representatives of the trade societies, and the Council shall give the various trade societies seven days' notice of the names of any firms whose tender has been accepted before the contract is sealed.

(*e*) Failure to comply with the above conditions is to render the contractor liable to have his name removed from the list of eligible contractors, and to payment of a fine not exceeding £500.

(*f*) Any of the contractor's workpeople who may have been injuriously affected shall be compensated out of any fine so paid.

The General Purposes Committee, to which the matter was referred, obtained information from other towns, interviewed representatives of both the Trades Council and the Building Trades Employers' Association, and finally suggested the new clause, which is drawn up on the following lines :—

1. Contractors must pay the rates and observe the hours and conditions of labour which are mutually recognised by the local trade union and the employers' association while carrying out all work pertaining to the contract.
2. If there is doubt of this, the contractor may be called on for proof of his compliance with the conditions.
3. When a contract or part of it is sublet, the consent of the Council must be obtained, and the main contractor is still to be held responsible for the due observance of these conditions. In case, however, a sub-contractor is nominated by the Council, the main contractor's liability is limited to an endeavour to get the concurrence of the sub-contractor to the labour conditions, and should they be violated, the main contractors are only to take action on the advice and at the expense of the Council.
4. Should the main contractor fail to carry out these conditions, the contract may be cancelled and a fine of 20s. inflicted for every workman who may be proved to have been affected.
5. These stipulations are not to apply to material purchased from outside sources, to patented articles or to stores or miscellaneous articles.
6. These conditions are to be made known to all tenderers by the committee inviting tenders.

It will be noticed that the clause as adopted by the Council is far less stringent than that proposed by the Trades Council, for in the one case the obligations were to extend to the regular practice of the contractor, and in the other only to the work carried out for the Council. The clause as proposed by the Trades Council also included the whole contract, and made no exception of purchased material or sub-contractors nominated by the Council. We think that in these limitations of the operation of the clause the Council acted wisely, and in the truest interest of the workpeople themselves. It remains to be seen what action the Council will take the next time an attractive foreign tender for machinery is submitted to it. The spirit of the adoption of such conditions of contracts as these implies that all who tender under them are bound by them ; and since foreign factories are outside the scope of their operations, their owners should be excluded from making offers on equal terms. The new clause, if strictly enforced, contains little which first-class British contractors would object to, while it safeguards the interests of the workpeople so long as the competition is limited to British manufacturers.

Electrical Financing Banks.

A VERY high opinion of the two electrical banks which were formed in Germany a year and a half ago is not entertained by the *Berliner Tageblatt*, which states that the institutions have led quite a hidden existence since that time, and have not yet been able to give proof of their necessity or utility. The banks were conceived as financial companies for electrical undertakings on a large scale, but their co-operation has hitherto not been demanded in any financing of the kind. The great electrical firms which promoted the banks have apparently somewhat over-estimated the rate of the process of conversion of the system of power production and means of transport, especially in so far as they concern the State and the Communes, but the whole financial basis of the banks was shaped precisely according to the requirements of the public bodies, as the grant of long term credits to private individuals would not have offered the same security as the basis for the obligation or bond capital to be issued by the institutions.

Apart, however, from the slow pace at which the transformation of main lines of railway and municipal lighting systems to electrical working is being accomplished, another factor has exercised a hampering influence upon the electrical banks, namely, the development of the money market. At the time when the institutions were formed or were in preparation, there was a scarcity of money in Germany. The flotation of loans during this period was accompanied by difficulties both for the State and the local authorities, and could only be effected on unfavourable conditions. It is, therefore, quite comprehensible that these authorities restricted the raising of loans only to those of the most urgent character, and, moreover, postponed them as long as possible. It was this situation of affairs which probably created the idea among the principals of the electrical firms of providing institutions which would afford the possibility to the States and the local authorities of obtaining funds for proceeding with modern electrical problems without being compelled to appeal to the money market. As will be remembered, the organisation of the banks was so conceived that credit was to be granted in the form of long-term advances on mortgage or other security, whilst on their part the banks were to issue obligations, similarly to the mortgage banks, on the basis of their claims and securities. As the banks would have had to pay at least a minimum of 4 per cent. interest on such bonds, the money lent by them to those desiring credit would have had to be at a somewhat higher rate, as although the principal object of the banks was to act as feeders of work to the electrical manufacturing firms, they could not have worked quite without profits, having regard to the large sums involved in the loans.

The chief mistake in the calculations of the electrical firms, which wished to be both contractors and financiers to their customers, is stated by the Berlin newspaper to have consisted only in the circumstance that they desired to build up their structure upon the narrow basis of a transitory situation, although regularly returning at certain intervals, of the money market. But before the organisation of the banks was quite completed, the tension in the money market had given way, and the circles to which the banks principally intended to turn were able to obtain the money they required in the usual way on more advantageous conditions than by the roundabout way of the electrical banks. It is for this reason that the services of the banks have in no case been requisitioned in connection with the numerous electricity works and "overland" central stations which have been erected or projected with the co-operation of the local authorities, or with municipal or State guarantees, in the past year and a half. On the other hand, the right of lending money has been restricted in the interest of the security of the obligations to the inland market, and this has prevented the embarking upon many foreign transactions which would have been quite suitable for the purpose.

Although it results from what has just been set forth that the business passivity of the banks is due, in the first place, to the lack of opportunity for transactions, it has yet the appearance as if a deep-lying disinclination prevails in certain circles which would come into consideration as borrowers, against the financing of electrical schemes by the financial companies of the electrical contracting firms which would carry out the work. It seems in particular that the banks have scarcely any prospect of playing a large *rôle* in connection with the electrification of main lines of railway, as the State railway authorities concerned probably have scruples against breaking through the purely State working character, and the purely monetary management of their railway system according to the Budget, by concluding credit agreements with private undertakings. Taken as a whole, the Berlin newspaper remarks that the great hopes with which the banks were brought into existence have hitherto not been realised, and are not likely to be fulfilled to the full extent. Nevertheless, the last word has not been spoken in regard to the idea of the electrical bank, which probably contains a fruitful kernel ; and just as an unfavourable period has kept it down, so may a favourable term of prosperity raise and strengthen it. It is added, in conclusion, that it, perhaps, depends in this case, as in many other things, upon first making a beginning.

A DARLINGTON 500-KW. EXHAUST STEAM TURBINE.

It will be remembered that, in March of last year, the Darlington Corporation, in order to cope with the increasing demand upon their electricity station, invited tenders for the installation of a 500-kw. exhaust-steam turbine generating set. From amongst an interesting list of tenders, the one submitted by Messrs. Belliss & Morcom was ultimately accepted. The work has recently been completed, and the new plant has now been in successful operation for some weeks; by the courtesy of Mr. J. R. P. Lunn, the Corporation's engineer and manager, we are enabled to give in the accompanying illustration a view of this generating set. The turbine, which develops about 800 B.H.P., and is worked entirely by steam exhausted from reciprocating engines previously installed, drives a 550-kw. generator, running at 850 R.P.M. The turbine is of the plain exhaust type, but it is fitted with a high-pressure governor valve as a stand-by, the high-pressure steam discharging therefrom directly into the low-pressure steam chest; both the exhaust steam and the live steam supplies are fitted with governor valves.

The turbine and engines are occasionally required to supply separate bus-bars, but when in parallel the low-pressure governor valve is speeded up so as to be practically inoperative. The turbine proper is of the impulse type, the first set being compounded for velocity and supplied by a number of hand-controlled nozzle valves, the latter stages being compounded for pressure only. In these stages the rows of moving blades are assembled on a common drum instead of —as in the majority of impulse turbines— on a series of disks. The fixed, or nozzle, blades for all stages are assembled in segmental panels and secured to steel rings, each being perforated with 6 or 12 arcs of varying lengths to provide the requisite expansion. These steel rings are permanently caulked into the casing, and the panels of the blades are assembled in such a manner as to be readily removed and replaced. Following usual practice in impulse turbine design, there is a considerable clearance over the moving blades —about $\frac{1}{4}$ in. to $\frac{3}{8}$ in. A final clearance between the fixed cell walls—in this case the steel rings—has been, of course, necessary, and the edges of the steel rings are, therefore, suitably lightened to obviate damage in the event of a "rub." Stripping of the blades is rendered practically impossible by this method of construction, and our representative has been informed by Messrs. Belliss & Morcom that although in their earlier experiments they have had numerous "rubs" from one cause or another, they have never stripped a blade. The whole of the gearing and mechanism of the oil pump, governor and oil relay is enclosed in the end casing, and all the moving parts are forced lubricated. The glands on the turbine are steam-sealed by the exhaust from a feed pump. The view shows the turbine *in situ*, the exhaust steam being received from the adjoining engines. The engines are now exhausting at a pressure of 13 lb. per sq. in. higher than before, and their output for a given amount of steam is somewhat reduced, but as the thermo-dynamic efficiency of a turbine is so much greater than that of an engine at pressures below atmosphere, the turbine and the engine combined are generating from the same amount of steam, 30 per cent. more electricity than the engines alone. About two-thirds of the power developed by the turbine is obtained from heat which had previously been wasted owing to the inefficiency of reciprocating engines at low pressures. All the bearings of the turbo-generator are supplied with oil at a pressure of about 40 lb. per sq. in., and the oil, after passing through the bearings, drains back to the pump; the governor valves are also worked by oil pressure regulated by a relay valve. The approximate cost of this new turbine set, including pipework, foundations, &c., was £2,900.

The Darlington municipal electricity undertaking has always been able to show very satisfactory financial results. The total capital expended up to March 31st last was £73,994. The total capacity of the plant, including the new turbine set, is now 1,900 kw., and the maximum load recorded, 1,268 kw. The total connections of all kinds are 3,750 kw., showing an increase of 19·4 per cent. over the previous year's figures. The private lighting, equivalent to 8-c.p. lamps, amounts to 47,830, a percentage increase during the last year of 21·5, while 1,799 H.P. of electric motors are now supplied from the Corporation mains, and 31·4 per cent. of this total has been connected during the 12 months ended March 31st. The total cost per unit, excluding interest and depreciation, was only ·636d., as against ·676d. per unit in the previous year, a figure lower than that of any other electric supply undertaking with an output of less than two million units per annum.

Belliss 500-kw. Exhaust-Steam Turbine Set, Darlington Corporation Electricity Works.

The Corporation supply ordinary consumers at 3½d. per unit, and long-hour consumers at a lower rate, while they are supplying power to their tramways department at 1d. per unit, and to the large works at under 1d.

During the 12 months ended March 31st, 1,834,676 units were sold, an increase of 20 5 per cent. over the total for the previous year. The total income showed an increase of 7 per cent.; the increase in the income from lighting was 9 per cent., the increase in the income from power was 18 per cent., while the income from public lighting remained stationary, and the income from traction showed a decrease of 7½ per cent., owing to the reduction in price from 1½d. to 1d. per unit. Notwithstanding an increase in the charge for rates and taxes and the reduction in price to the Light Railways Department, the gross profit for the past year was £7,402, as against £7,170 in the previous year, the net profit being £2,190, as against £1,933.

Debate on the Effects of Free Trade or Protection upon the Electrical Industry.

Free Trade: Mr. J. E. Kingsbury. Protection: Mr. Hugo Hirst.

THE above was the subject announced for discussion at a meeting held on Monday night last at Caxton Hall, Westminster, and in response to a very widely circulated invitation by ticket and in the Press, between 200 and 300 gentlemen assembled to either take part in or listen to the debate.

The invitations were issued by the National Electrical Manufacturers' Association (Inc.), the largest association in the country representing electrical manufacturers, whose membership includes men of various shades of trade and industrial opinion. The chairman of that Association, Mr. H. W. Butler, of the Electrical Power Storage Co., Ltd., presided over the meeting. At his right hand sat Mr. J. E. Kingsbury, who opened the ball from the Free Trade point of view; Mr. Hirst, who led from the Protection point of view being at his left hand. Among the other occupants of the platform were Messrs. F. B. O. Hawes (the Association secretary, to whom thanks and credit are due for the manner in which the meeting was organised) and E. Garcke.

The speeches of Messrs. Kingsbury and Hirst were listened to with rapt attention throughout. Both gentlemen, as everybody who knows them would imagine, spoke with obvious sincerity and deep conviction, Mr. Kingsbury's attitude being one of quiet confidence in the soundness of his case, while Mr. Hirst spoke with equal assurance that the remedy for which he argued was absolutely essential in the interests of our electrical industry.

But both gentlemen were more or less at a disadvantage. Caxton Hall with open windows and passing trains is not a desirable place for any speaker unless he maintain stentorian tones from start to finish. Therefore, until, at the suggestion of a member of the audience, there was a general closing up of ranks toward the platform—the hall was about half filled—and a shutting of windows, some of Mr. Kingsbury's sentences were lost to us in the rumble of trains or in an ill-timed cough. Mr. Hirst was at a disadvantage, inasmuch as he was only just recovering from an attack of gout, and we are inclined to think he would have championed his cause better had he *read* the Protectionist statement that he had prepared, as the Free Trade advocate had already read his. However, as the meeting only had the opportunity of listening to two or three other speeches, the gathering was adjourned for a fortnight, and when the discussion is resumed, at the same time and place, on Monday, June 6th, everyone who was present last Monday will have read the prepared statements for himself, and having thoroughly digested them both, will be better able to contribute profitably than would otherwise have been the case. To this end we give the two arguments *in extenso*, and as the remainder of the speeches will be reported in our next issue, every point put before the meeting will be in the reader's mind before the resumed proceedings.

The speakers of Monday last, after the opening contributions had been delivered, were Messrs. J. S. Raworth, E. Cowan, Harland Bowden and Bennett Fitch, the adjournment being made on the proposition of Mr. Garcke. It is expected that the debate will be resumed by him, and that among other speakers will be the following:—W. P. Durtnall, H. H. Berry, Oppenheimer, Bruce Anderson, Dawbarn, Stewart and W. G. Bond.

Chairman's Speech.

The CHAIRMAN: We are here this evening to hear a most important discussion, and an interesting one, on a very urgent topic—I might almost say the burning question of the day—the effect of Free Trade or Protection upon the electrical industry. Before calling upon the gentlemen who have so kindly consented to open this discussion to-night, I may perhaps be allowed in a very few words to tell you the reason why the Committee of the National Electrical Manufacturers' Association decided to promote this meeting. The National Electrical Manufacturers' Association, as probably you all know, exists for the purpose of dealing with all questions, commercial questions, which are of general interest to the trade, and, in addition to dealing with those questions, it also forms a common platform where all the members of the trade may meet and discuss the various questions of policy, and so on, which are for the benefit of the trade as a whole. The Association, as an association, has no power to take sides on questions such as we are discussing to-night, therefore there will be no resolution put to the meeting, and it cannot be responsible for the opinions which may be expressed this evening. But when several of its members suggested that a meeting to discuss this question was one which would benefit the trade as a whole, the Committee unanimously decided to organise such a gathering in order to fully demonstrate that there existed such a platform for the discussion of such an important question. The two leading speakers this evening are too well known to you to require any introduction from me. I have, however, been requested to say that their papers have been prepared entirely independently, and consequently they can in no way be taken as answering one another. We are, I think, especially indebted to Mr. Hirst for coming this evening, and you will bear me out in this when I tell you that he has had a very severe attack of gout, and it was only this evening that he was able to get permission from his doctor to come out. I will now call upon Mr. Kingsbury to open the debate from the Free Trade point of view.

For Free Trade.

MR. J. E. KINGSBURY: Mr. Chairman and gentlemen, when I was asked to take part in your debate to-night, I confess that its responsibilities rather overawed me. I was extremely reluctant to take up the position, and I am somewhat doubtful, I must admit, of its utility. My friend Mr. Hawes, your able secretary, persuaded me out of my reluctance, and I reflected that if your committee were prepared to take the responsibility of any good or harm which might result, why, I need not trouble myself any further about it.

One of the effects of Free Trade is that the electrical industry of Great Britain has a higher efficiency than any in the world. I am not indulging in flattery or expressions of vainglorious patriotism. I do not say every department is better or any department bigger than can be found elsewhere, but that the industry, as a whole, has a higher efficiency. Manufacturers and users alike are striving for higher efficiency—better results with less expenditure of energy or money, which is practically the same thing. If the suitability of the instrumentalities is inferior or the cost excessive the efficiency is low. In no protected country can the engineer extend his horizon beyond the frontier and advise the use of the most suitable instrumentalities regardless of their birthplace. In no protected country can the purchaser exercise his choice except at a cost which is an addition to the value. In the selection of their material our engineers and constructors have been unhampered. The nation has added nothing to the price. Think what that means in the balance-sheet of the electrical industry. Apply the same line of reasoning to other British industries and consider the value as a national asset. Observe its bearing on the advance of an industry and particularly our own—one of the newest. You cannot measure such advance by comparisons—you can be sure that increased cost (*i.e.*, reduced efficiency) would retard progress. And yet we are told that Free Trade is a mistake; that we ought to have built up the industry on Protection. For some years insidious efforts have been made to counteract the operation of Free Trade by the development of an idea that patriotism required the engineer to limit his range of vision and the purchaser to fetter his freedom. Measure the results in efficiency, and the consequences in balance-sheets, and which do you think is the truer patriotism—to extend the benefits of an industry and add to the nation's profits or to retard the development of an industry and add to the nation's loss? It is long since we have heard the once familiar phrase that "electricity is in its infancy," and I have no intention of reviving it, but we ought to remember that the electrical industry is still young. Its youth is partly responsible for its international character. No one nation can claim pre-eminence either in discovery or applications as a whole, though some may claim such pre-eminence in certain sections, and the claims can be substantiated. Every cultured nation has contributed its quota in scientific discovery, and applied itself with zest to its development, and since it has been the province of electricity to supersede some other agency in most of its applications, it is not surprising that early advances should have been more rapid in communities where the other agencies had not been so long established as to take deep root. Our Free Trade policy permitted us to apply at once any advance made elsewhere, and to give the industry a start on the most economical lines. So soon as the demand became large enough to permit economical manufacture, we abandoned imports and manufactured for ourselves. Our imports, in all probability, afforded a profit to the exporters. You Protectionists grudge that profit to the exporters, you think it was a loss to this country. I see in it an enormous gain. By reason of our more settled conditions our development in some departments was necessarily slower than that of some other countries. We were able to make a start at once in any

applications not originating with ourselves. We were able to adopt the most suitable instrumentality, and obtain the benefit of its successive improvements at small cost. Protection would have delayed us for years, and enormously increased the cost. Protected States are behind in the development of enterprises originating in other States. We can adopt and develop without delay and without restriction. That such freedom of action is good for the user there can be no doubt, and it is also good for the electrical industry as a whole, for no article is imported and put into use without leading to the employment, directly or indirectly, of our own manufacturers, sometimes of very much greater value, and employing considerably more labour than the imported article itself. Our progress in the past, though not stupendous, has been steady. Our applications in some departments are not what they should be, or what we might expect them to be. In pursuance of that unfortunate policy of detraction which is a part of the Protectionist propaganda, we have been, and are being, held up to the world as exceptionally backward. Well, the United States is a particularly electrified nation. Their electrical products in 1904 were 6s. 10d. per head of population. Ours in 1907 were 6s. 2d. The years are the nearest available for comparison which I have been able to obtain. The larger rural population of the United States must be taken into account, but, on the other hand, their values probably represent less material. With all allowances being made, do the figures justify the mournful moanings, and the gloomy prognostications in which our Protectionist friends indulge which go forth to the world in such striking contrast to the proud boastings and confident anticipations of our competitors? Our progress is substantial. Lack of progress in any department can be readily accounted for by our conditions or our own errors. Free Trade has helped us. With Protection our position would have been deplorable. Now the industry is established. We are equipped to do more work for ourselves and the work of so much of the rest of the world as we can get, and we are asked to throw away our most efficient aid to both—to abandon our trusty staff and lean upon a broken reed. I think I am stating fairly the Protectionist's argument when I say that it is claimed that Protection makes the foreign manufacturer sure of his own market; that he can thereby organise with confidence for the supply of that market, can arrange for the production of a surplus to dump in our market, and can secure for his employés continuity of employment. These are the advntages which Protection is alleged to give the foreign manufacturer; they are the reasons which are presumed to account for his progress, and the inference is drawn that if we had Protection the same advantages and the same progress would accrue to us. The argument is sufficiently plausible to be very generally accepted, but I have to question both the statement of the facts and the inferences drawn from them. We talk in a vague way of the competition we experience from another country and then in an equally vague way of the production of that country, when we mean the competition of individual firms in that country and the productions of individual firms of that country. Now Protection does not make any individual foreign manufacturer sure of his market. He is open to the competition of other manufacturers in his own country, and he, therefore, has to exercise his judgment of what he will produce, and how much of it he may safely produce, just as much as the manufacturer in a Free Trade country, except for the fact that any competition he may have to fear is that arising from within the national boundaries. This reduces the area of competition, but prevents that calm confidence with which he is credited. The argument presupposes that there is only going to be one manufacturer and one output. The tendency of Protection is in that direction, but it has not yet been reached, and the progress of our foreign competitors cannot consequently be attributed to it. The argument for the continuity of employment is negatived by the facts. Neither Free Trade nor Protectionist countries are free from the vicissitudes of trade, and trouble in one country will affect another country, but it is a well-recognised fact that the trade of a Free Trade country is less disturbed, and employment more regular, than that of a Protectionist country. Whatever complaints can be made of the volume of electrical trade in Great Britain, it cannot be said that the employés of that trade have been subject in recent years to such sudden and such extensive reductions as have taken place in the United States and Germany. There is another argument for Protection which I sometimes think a very strong one. It is the argument of educative influence, the development of growing industry. Manufacturers say, "If we do not begin to make these things all the experience will be with other countries and a manufacture which might have been ours will be lost to us for ever." Such an appeal as that is likely to strike a responsive chord and meet with a sympathetic reception. It assumes that opportunities have been lost, and implies the merit of looking ahead and preventing the loss of similar opportunities. The educative argument is less direct than the employment argument, and it is, perhaps, on that account the more important. Now I want to suggest to you that to start a factory for the purpose of serving as a school is an expensive form of education, and when it is maintained by a Protective tariff the amount paid in fees is likely to be very serious. The large amount of attention given to the profits of manufacture and the small amount of attention given to the purpose of manufacture cannot be very readily explained, but it is worth inquiry. Consider for a moment the difference between the profit on the manufacture of a spade and the potentiality of profit from that spade in use. A small agricultural community that insists on placing a restriction on the importation of the best and cheapest spade is taking a measure that must react upon its own development. In process of time the requirements of the community become large enough to permit it to manufacture its own spades at a price that will be lower than the imported article. It would pay the community better to develop its resources by imported spades and pay for the education of artificers from its surplus crops rather than to set those artificers to work to produce imperfect or unnecessarily expensive spades, which would retard the progress of its agriculture. Early local manufacture can only be undertaken where the soil is so extensive or so productive as to leave a wide margin over necessary sustenance, and as this is generally the case in newly settled countries, the settlers are enabled to give rein to their ambitions to extend the scope of their occupations. But in a settled country, there is usually no such margin, and no such occasion for such ambitions. The value of the article in use should be the prominent consideration. Its use should be encouraged, and yet the principle of Protection is to discourage its use by delay or excessive cost. I have only called that spade a spade metaphorically. You can call it an electrical implement—anything you like, from a new lamp to a new tram-truck. Such an improvement, which may now be imported from abroad in a finished state, cannot be placed at once upon the market if manufactured at home. It will take time—perhaps a year or two. During that time you ask that the buyers of the improved apparatus shall pay you a royalty on what your heads have not designed or your hands fashioned. In using the term "pay you a royalty," I am, of course, only adopting a figure of speech. What you propose is that the nation should fine such purchasers for buying foreign wares, but the purpose of the fine is that you shall get the benefit by restriction as much as possible to your own sources of supply. The effect of such restriction must be that the user will lose in efficiency, the advantages of the possible economy cannot be so widespread, and the demand will not assume proportions to justify economical manufacture at so early a period. Thus the home manufacture is likely to be delayed rather than accelerated by protective measures. The same warped conception of a simple benefit is noticeable in relation to dumping—an expressive word which needs no more explanation than the word "boycott," to which it has some relation. "Dumping" in connection with trade and commerce is reserved exclusively for inter-State transactions. A British purchaser having the alternative of making a bargain with British sellers is not asked to take into account any other consideration than the quality of the material and the price at which the transfer of ownership can be effected. It may suit one of the sellers to dispose of surplus stock, or he may have some more economical method of production which enables him to offer a lower price than the other. Whatever the circumstances may be, the purchaser is permitted to make his purchase in the cheapest market without any reprehensible reflections being cast upon him, and nobody describes the sale as "dumping." Such a term only becomes operative when a foreigner in competition with British sellers exchanges ownership with a British purchaser. The term is, consequently, identified only with international commerce, and is intended, by arousing international prejudice, to limit transactions within the nation. Nothing can be said against the principle of leaving to the buyer the exercise of his individual will. There is, and always will be, I hope, a preference for the interchange of commodities within the nation or the Empire, but I venture to submit that it is unbecoming a great commercial nation with a world-wide trade for any section of its traders to endeavour to limit the freedom of the individual by the creation of a public sentiment based on international prejudice. If such principles had governed British commerce in the past, Great Britain would not be a great commercial nation. If they are allowed to operate in the future, Great Britain will inevitably cease to be a great commercial nation. When the prejudice is utilised to further the claims of Protection it becomes a double evil. I shall have occasion later to examine more closely the measure of "dumping" in the electrical industry. I would simply ask you now to approach the consideration of international purchases and sales as far as you possibly can free from the prejudice which has been so industriously fostered. At a time when we have not work enough to go round amongst ourselves, the introduction of a policy which should secure the margin of that work at present lost, and which should have also the not improbable effect of improving the profits on the remainder, sounds tempting—so tempting, that it is not surprising numerous adherents should be found. But you must remember that what we are talking about to-night is for practical purposes, not what will be the effect of Protection applied to the electrical industry alone, but rather what is going to be the position of the electrical industry if Great Britain gives up her Free Trade and adopts Protection generally? The responsibility which lies upon the promoters of the protective policy is a large one. Their belief in its necessity must be profound, or their careless trifling with the destinies of a nation deplorable. But profound belief does not relieve them of the responsibility of demonstration. Happily, I think it can be shown that there is no conflict between the interest of the electrical industry and the interest of the nation. As a fact, there never was any conflict between the interests of any industry and that of the nation, but I am not so sure that it can always be so easily seen. Observe the danger, then, of approaching the consideration of the greater question—*via*, the smaller—as is so frequently done. You are asked to adopt Protection so as to limit the freedom of action of those to whom you sell. Other industries are asked to do the same. Do you and the other industries realise that by your adhesion you are preparing fetters for yourselves and for the trade and commerce of the nation as well? "Where fetters are to be worn, it is a wretched ambition to contend for the distinction of fastening our own shackles" said Sheridan on one occasion in the House of Commons. Do you want to contend for the distinction of fastening your own shackles? If you believe it is for the general welfare you can do nothing else, but have you taken all the precautions necessary to assure yourselves that it is for the general

welfare? It is not our province to-night to examine in detail the proposition before the country, but a consideration of its probable effects are essential to reach a conclusion on the point that is before us. The trade and commerce of Great Britain, and the consequent position of London as the centre for international financial transactions, are the envy of the whole world. The manufacturers of Great Britain must not assume that they can consider the introduction of Protection apart from its effects on trade and commerce. A study of the growth of that commerce under Free Trade conditions, a careful weighing of the arguments of financial authorities can only lead to the conclusion that with the introduction of Protection our supremacy must wane and our trade decline. What will it profit you to secure your home market if thereby you reduce it to insignificant proportions? Let us see what the position of the home market is? In 1907 we imported roughly about 17½ per cent. of our consumption. We will call it 20 per cent., and that may, perhaps, be divided by two to indicate the imports which are new or advantageous, and those which compete with our standard manufactures. The novelties are wanted to maintain our efficiency and promote the use of accompanying manufactures of our own. Our grievance, then, is that 10 per cent. of our electrical consumption is imported, and could have been made by ourselves. It amounts to a little over three-quarters of a million pounds. Does the case seem quite a strong one to put before the electorate? Is there not danger that some of them, at least, might remind us that the retention of our home market might possibly result in the ruin of our export market. Our exports must grow, but we have keen and alert competitors. Every advantage at our disposal must be used. Free Trade is the greatest advantage of all. I do not know that I have seen this more clearly stated than in the following quotation from an article in the *Daily Telegraph* some time before Protection was exhumed:—"The logic of Protection involves the rejection of foreign trade to preserve an internal monopoly. When supremacy in international commerce has become an object, the maintenance of exclusive tariffs becomes injurious and absurd. It is like nothing so much as the process by which the case armour in the Middle Ages was increased in weight until it disqualified the combatant, so that churls and peasants came up with unknightly weapons when splendid signoirs were once unhorsed and hewed them to pieces like logs as they lay prone under their harness." There is reason to believe that that case armour has already told upon one of our competitors. Upon another the weight is not so great and the frame is yet too strong for it to overbear some other advantages, but the weight will tell with the period of wear; the cost of production will increase as the cumulative effects of Protection permeate the fabric of the State, and the bills for stimulated progress and enterprise come due for payment. To our electrical exports we must look for developments, and we are asked to discard the weapon which we know gives us our advantage in cheap production, and promotes that over-sea trade which facilitates the exchange of our manufactures for others' products. And in place of the weapon which has proved its utility we are invited to adopt this protective armour of the Middle Ages, whose deadly weight would crush us with more celerity and greater certainty than any other nation. The dependence of the electrical industry upon the general trade and commerce of the nation cannot be questioned, and it is to be regretted that more attention is not given to such points and less attention bestowed on minor questions, which, whilst making appeals to individual interest or sympathy, have much less effect on the real settlement. Our feelings are harrowed by appeals for Protection to prevent the ruin of industries, or to assist in the building up of those we have hitherto been able to do without. As if it were not established that an industry ruined in a Free Trade country has another industry growing out of its ruins, and an industry protected in a Protected country needs more and more protection. I will give you an example of each. The policy of stimulated exports of sugar from the Continent crippled our sugar refining, and had serious effects on our sugar growing, but it gave us cheaper sugar upon which other and larger industries have been built. Our Free Trade policy of buying in the cheapest market was justified by results, and if we had tried to save a threatened industry we should have lost an important outside contribution to our finances—how important you can judge from the statement of a writer in a Berlin review, who estimated that the annual contribution of the Continental taxpayers to the English Treasury by means of the sugar bounties was equal to the interest on 150 million pounds, the amount expended on the South African War at the time of his writing. My other example is of increase in duties. In 1853 Mr. William Chambers, a member of the celebrated publishing firm, paid a visit to America, and recorded his impressions. He remarks that the prosperity of Lowell rested on the precarious foundation of a tariff which excluded the more cheaply produced goods of England. I understand that the tariff at that time was 25 per cent. *ad valorem*, and is now 50 per cent. *ad valorem*, plus 40 to 50 cents per lb. When anyone suggests the placing of a protective duty on our electrical industry in consequence of its infantile character, and considers it likely that the duty might be subsequently dropped, he might bear this example in mind. Amongst the many other arguments for Protection which are put forward, I must select only one more for comment. It is often urged by moderate men who do not recommend Protection as a good in itself, but think a tariff might be useful as a basis of negotiation and permit retaliation. Confining myself on this point to the electrical industry, let us face the facts. Can we say that any of our active competitors are so poorly equipped electrically that the operation of a retaliatory tariff is likely to lead to a reduction in their duties of any item which will facilitate our exports to them? You will, I believe, agree with me and answer No! In that event, Protection as a retaliatory measure is useless to the electrical industry, as it is equally useless in other respects. Time does not permit my commenting on any more of the numerous claims which have been advanced on behalf of the electrical industry for the abandonment of Free Trade and the adoption of Protection. I have been obliged to limit myself to a few bearing directly upon the subject which has been given me. At a time when so much has been heard of Protection, I suppose it must not be considered surprising that a section of those engaged in the electrical industry should have turned to such a policy in the hope of finding therein some remedy for "the present discontent." But I regret that it has been so, and I believe that the industry has suffered by the agitation. We must recognise that a difficulty exists in reaching a conclusion within the industry itself. It is not easy to acquire that complete capacity for detachment which could recognise that it can be good that our business should be spoilt by imports from a country to which it is impossible for our manufactures to be exported. A conclusion is I think more easily reached if we consider the interests of the nation. There can be no question then what is the interest of the industry. In considering the interests of the nation it is much easier if we abandon our return circuit ideas. It is no use thinking of trade and commerce in terms of out and home conductors that run in the same trough. We may do better by reverting to earth circuits. The return may be an unconscionably long way round, but which ever route it traverses we know it is the one of least resistance, and we know that it is complete by the work done. In spite of the important spots of rocky ground the rest is "good earth" and the whole is available. I should like, if possible, to see developed a more reasonable attitude on these foreign trade questions. We adopt for ourselves a policy which we think best, and we don't intend to let any other nation interfere with us. Other nations do the same and are in no way influenced by our arguments. In such a progressive industry as ours, in the developments of which, as I have previously said, all cultured nations take an active interest, it is not reasonable to suppose that anyone can produce the best of everything. We know that it does not. We have much that others could take with advantage to themselves. They shut their doors. Shall we also shut ours? In the case of anything which benefits us it would be a mistake, and our Free Trade policy prevents our making such a mistake. But we know that there are compensations, though not always directly traceable to a particular industry. Yet I do not see why we should not imagine a part of the Continental contribution in the Sugar Bounties as having been expended in the electrical equipment of a chocolate or a biscuit factory. We must sympathise with the trader who finds his sales affected or the profits reduced by imports from a country from which his own products are rigidly excluded, but if we legislate for hard cases we start on the road to ruin. The operation of Free Trade is eminently fair. It may deal out hardship with one hand, but it promotes prosperity with the other. The trade returns of Great Britain, the condition of the population of Great Britain (in spite of all deputations and detractors) clearly demonstrate the wisdom of our fiscal policy. Whether it be regarded from that larger standpoint, or from the more definite interests to which mainly I have been compelled to devote my remarks, I hope it will be seen, I think it will be seen, that the electrical industry only requires to use its right arm and make the most of its opportunities under the policy of freedom of trade.

I have finished the task that was set me in the presentation of the case for Free Trade. The other side has yet to be put before you. I am not going to prejudge the conclusion. You who have your doubts whether the fiscal system for which our fathers strove, and under which we have for half a century thriven, is good enough to go on with, you who are not quite so satisfied as I am that Free Trade is essential to the progress of our industry, can at least have no doubt that the effect on the electrical industry of the continual decrying of our powers which accompanies the agitation for Protection is extremely detrimental. If you have so little confidence of your powers in open competition, can you be surprised that others should have even less? Whilst you are pursuing what I believe to be a will o' the wisp, are you possibly neglecting opportunities of taking practical measures for ameliorating any of your conditions which may need amendment? The best and strongest firm cannot afford to lose goodwill. Now Great Britain's loss in goodwill in the last few years has been serious entirely from the deprecatory arguments of the protective agitation. It would have been more serious, but for the fact that our customers, our friends and our competitors have not taken us quite so seriously as we take ourselves. Unless you are satisfied that Protection is a real necessity, unless even you believe that the electorate can be convinced of that necessity, it is a mistake to continue the agitation for Protection.

For Protection.

Mr. H. Hirst: By the ruling of your chairman and your committee I am not permitted at this juncture to deal, as I am eager to do, with the way in which my friend Mr. Kingsbury has stated the case of "Free Trade and the Electrical Industry," but I may be allowed to express my heartfelt appreciation of the interesting, informing and able manner in which he has handled a very difficult subject. I look forward to another occasion to discuss in detail the arguments which Mr. Kingsbury has urged with so much personal conviction, and I hope we shall then have the benefit of the knowledge and experience of some distinguished men in our profession or calling who are present to-night, or will be present at the second meeting, which I trust it may be necesary to call. I feel that I must take this opportunity to congratulate the Chairman and Committee of the National Electrical Manufacturers' Association on having organised this meeting and thus afforded the leading members of the electrical industry an opportunity of exchanging their views on the question fraught with immense potentiality not

only to the industry itself but also to the country as a whole. Nothing but good can come of a frank exchange of views amongst the various units of the industry here represented. I only regret that for so important and complex a subject as Protection and the Electrical "Industry" your Committee has not chosen a more able and deserving exponent champion than myself. I hope, however, you will be charitable to my deficiencies. I possess neither gift of rhetoric nor genius for statistics, but I may make up for these shortcomings by my somewhat unique experience as a manufacturer, for as such I have not only produced almost every class of electrical commodity in this country, and this has naturally brought me into contact with our own economic conditions, but I am also associated with concerns manufacturing and selling in Protected countries; while, again, I am still further fortified by my actual experience as a free importer of foreign-made goods. It is the privilege of an Englishman to grumble at any and everything. Now, it appears to me to be a very peculiar thing that although we grumble at our present position as manufacturers individually around our firesides and on political platforms, electrical manufacturers as a body have been reluctant to express their views. Yet if our own and other industries were to collectively make known their opinions, and if the demands of the majority were heard, what a tremendous help it would be to statesmen of both political parties in their endeavour to do the greatest good for the greatest number. On the other hand, the most direful and misleading results can follow indecision and halting counsels on the part of industries like our own. When one industry shouts loudly for a continuance of Free Trade, and other industries, which need Protection, remain silent, the result is bound to be harmful to the country. It may safely be stated that the indecisive results of the last Election on the subject of Tariff Reform were largely due to the loud and insistent voice with which the cotton industry clamoured for Free Trade. Yet other industries of this country have a perfectly good and fair reply to give to the cotton spinners; and as that subject has now become one of general interest to the country, and as before I deal with purely the electrical industry I must necessarily refer to some general considerations, I take this opportunity of suggesting a reply to what we have been told from Lancashire and Yorkshire. First, it is not generally understood that the cotton industry already enjoys a kind of protection through the ideal climatic conditions for its particular work, the artificial reproduction of which in other countries has, so far, met with partial failure. Secondly, that every argument brought forward in favour of Free Trade for their manufactures by the cotton spinners is, in reality, an argument in favour of Protection for every other industry. What do they say? This, in short. In case of Tariff Reform, the workshops in this country would get busier; the demand for labour would increase; the standard of wages would go up; and, in consequence, the cost of production might increase and interfere with their own competing power in foreign countries. Now, in the absence of a published census of the production of the cotton industry, it is difficult to say what is the exact proportion of manufactured cotton goods in relation to other productions of this country. By circumstantial evidence, however, I conclude, and I am erring on the generous side when I suggest the relation is 20 per cent. for cotton and 80 per cent. for productions of other industries. Now, is it fair that the interests of the latter should be altogether subordinated to the interests of the former? You must not forget, firstly, that a large proportion of our cotton exports can only come from Lancashire, for the simple reason that they can only be produced in Lancashire. Secondly, the proportion of wages relatively to the total output of cotton goods is again, at a generous estimate, only 30 per cent. of the total value of such goods, and a rise in wages of 20 per cent. would, therefore, only mean 6 per cent. increase in cost price. Now, that little difference against the cotton industry could easily, I should say, be equalised by two or three features, partly resultant upon the introduction of Tariff Reform. (1) A certain amount of goods now imported would be excluded, and it would bring additional work to the cotton spinners of this country. (2) Reciprocal and preferential treaties with other countries would come into existence and be a potent factor in building up markets which the cotton industry can now only enter under severe competition. Finally, before dismissing the subject of the cotton industry, Have we not a right to ask ourselves whether all is well with it? Is it not an admitted fact that in spite of an increase in the population of nearly three and a half millions during the last census decade, the number of cotton operatives has actually decreased by 23,000, whilst in other countries it has increased. Do you gentlemen here realise that there are only 580,000 operatives engaged in the cotton industry in this country, and is it not a fact that we electrical engineers more than anybody else have noticed a spirit of *laisser aller* instead of *savoir faire*. Are we not mindful of the report recently published by an important section of the cotton industry that they considered electric driving unsuitable, when we know from personal experience and the experience of other countries that the cost of production can be considerably reduced by the introduction of electricity and modern plant in cotton mills. Another general point that I should clear away before proceeding with the discussion of the actual subject of this evening relates to a definition of terms. We are discussing "Protection and the electrical industry," not the electrical "trade." Speakers on this subject are not always careful to distinguish between trade and industry. I find that loose ways of speaking are almost always an index to loose ways of thinking. Too many people in this country have got into the way of coupling "trade" and "industry" as if they were convertible propositions. But they are nothing of the kind. As a matter of fact, good "trade" may very conceivably be the absolute enemy of "industry," and in that case it would necessarily prove detrimental to the aims and ideals of Tariff Reformers. If trade is to be profitable in proportion to its volume, it is essential that it should busy itself only with the import of such commodities as the land is incapable of growing or producing, and with the largest export of such commodities as the land can and does produce. In what does the wealth of a country really consist? It does not consist merely in cheap buying or cheap selling. Free Traders freely admit in all their text-books that the wealth of a country consists in its ability to produce cheaply relatively to its competitors in the world's markets. Is not this, therefore, the vital question—Under what conditions can we produce cheaply? I maintain that if you can establish such conditions as will enable the country to produce cheaply, you can turn 80 to 90 per cent. or more of the inhabitants of this empire into producers. If you look after the producer the consumer is automatically looked after, because consumers will then practically be also producers. But if the legislator—and you must not forget that in framing tariffs and in devising any fiscal system the law-maker is shaping for good or for ill the economic destinies of his countries—keeps only in view the consumer and neglects to force his country to produce up to the limits of its physical capacity, if, in short, he neglects to protect the producer and allows outside forces to limit the field within which he can profitably work, that legislator is limiting the benefits of legislation to the smallest number of citizens instead of extending them to the greatest number. The Free Trader argues frequently as if the country were divided into two numerically equal sections, the producer and the consumer. But in an industrial country like ours, if it is to maintain a high state of efficiency each consumer should also be a producer, though the nature of the production may vary, it may be industrial, agricultural, transport, exchange, or last, but not least, brain production. In this calculation, I, of course, include merchants as producers. So long as merchants do what is ideal for the country, viz., distributing, as far as possible, home-made goods and importing as far as possible the raw material which we require, I consider them producers. The same remark applies to the inland transportation service for the whole of the country. I maintain that Great Britain compared with its competitors had drawn nearest to this ideal state of efficiency at the close of that period of Protection which culminated in 1846. She was the chief producer amongst civilised nations. For a time the repeal of the Corn Laws appeared to have the effect which its champions alleged as their guiding motive, to wit, the expansion of our power of production by the reduction of its cost. But the student of history who examines the facts with an impartial mind, can only conclude that the results we obtained were snatched in spite of Free Trade. They certainly received a check as soon as other nations had the opportunity of so organising their economic forces as to place themselves in a position to challenge our industrial supremacy. It seems to me that three factors which are rarely mentioned, but which must be quite familiar to such an assembly as this, worked together to ensure our brilliant success as a producing country, in spite of Free Trade, and these causes were operative until about the early eighties. First, from 1848 to 1878 nearly all Continental nations were strenuously fighting for national existence, while those who were not actually engaged in war lived in almost daily fear of it. The concentration of their energies on this one absorbing, and to them vital, issue meant a large and profitable trade for this country in all kinds of war supplies. Large orders were constantly being placed in this country by belligerents in the same quarrel. In the Western Hemisphere much the same state of unrest, when not broken by actual war, existed throughout this period. The immediate effect of this condition of things was to stimulate industry in Great Britain, and to arrest the progress of the arts in other lands. Secondly, it so happened that the introduction of Free Trade in this country tallied with the development of steam as a power to reduce the cost of production. Under the favourable conditions in which this country was placed, it reaped the utmost benefit, almost exclusive benefit for a series of years from this new force. Thirdly, steam, by providing better means of transport, became a potent force in the opening up of new countries as markets for surplus goods. England was for a long time the only country to utilise to any extent, during a long period of peace and remarkable progress in invention, the steam engine, all kinds of textile machinery, and agricultural machinery and machine tools, and she consequently was the only country in a position to supply those distant markets. Such lands became most valuable outlets for British goods, not only for consumption in those lands, but what was of very great importance—this trade enabled us to collect the primary products of tropical and other countries giving us at once cheap raw material for our industries and profitable return freight for our vessels, and incidentally made us the distributing nation for these goods for all neighbouring countries. Thus was created a very profitable exchange business by which the wealth of this country was greatly increased during 1846 to 1880 period. This phase of the economic position was so patent that a school of thought arose which maintained that the prosperity and economic future of this country was essentially based on the business of exchange, and such factors as transport, freight, foreign investments, and so forth, and not on our country's power of production. In my view the factor of cheap production is the only one of vital importance, all the others, exchange transport, &c., following in its train. But those who have watched the progress of economic development during the past 30 years have been obliged to disagree with the conclusions of this school, and to no one has their philosophy been more completely disproved by facts than to the electrical engineer. In 1880 or 1881 Great Britain was at the zenith of her industrial power. Steam, gas, hydraulics, railways, steamships, electric telegraphs, celluloid, spinning, weaving and

knitting machines, rubber vulcanisation, dynamos, and I do not know how many more mechanical inventions, all of English origin, kept busy the factories and workshops of this country in supplying the markets of the world. Scarcely any engineering enterprise of any sort, whether in the way of railroad or bridge building, no tramway, gas or water scheme was set on foot in any country unless there was English brains, industry and capital at the back of it. Now, I would ask, How is it that in the short span of one generation our supremacy as a distributing nation is seriously challenged? How comes it that in so many industries where we were leading we have either been caught up or overtaken? Why is it that we no longer hold the market for raw materials, that we even have to purchase a good deal on the Continent, where, by the way, it is not produced. Why is it that in this country land is depreciating in value, whereas, in the countries which have challenged us so strongly, it is appreciating? Why is it that the standard of comfort among all classes, while developing very rapidly in the leading industrial countries of the world, can be satisfied more easily in almost any land than in this country? Why is it that unemployment, though to some extent incidental to all industrial lands, has become simply chronic with us? Above all, why is it that the proportion of skilled to unskilled labour is, in this country, diminishing instead of increasing? If we would obtain a striking view of this process of falling back in the world's industrial race, it is only necessary to compare the relative position of the electrical industry as it is in England to-day with the position it occupied a generation back. I am sorry to say that I am old enough to have a clear recollection of that time. The electrical cable and telegraph industry was exclusively in British hands. The manufacture of dynamos and incandescent lamps was a flourishing industry in England while that branch of technics was on the Continent still considered only suitable for laboratory research. It was in the early eighties that the firm of Crompton & Co. was summoned to Vienna to fit up the Opera House and the Emperor's Palace. There are many engineers in this room who, in those days, were busy with installations in Germany and other foreign lands. I myself was connected with the largest accumulator works in this country—a company of which your chairman this evening is so prominent a member—and I can well remember one of the directors of the A.E.G. visiting this country and raising his hands in astonishment at the great things we were doing here. The arc lamp industry, transformers, &c., were all developed in this country. Instead of a foreign country sending cables to the United Kingdom, they had to buy the machinery from us before they could make them. If in those days an electrical firm had establishments in England and elsewhere, it was always the English branch which was industrially the leader, but to-day, alas, that position is reversed. Now, in the course of the 40 minutes allowed me for my speech, it is not possible for me to give detailed reasons for every step in this downward path. I propose, therefore, to omit in favour of Tariff Reform all those arguments which we know well from the political platform. I only wish to confine myself to the one argument that, under Tariff Reform or Protection, we shall be able to produce in very much larger quantities, and by doing so we shall be able to produce much more cheaply. These two vital effects of Protection seem to me all important. We engineers know that in arriving at the cost price, the quantity you produce is a much more important factor in keeping the price of production lower than any advantage which a Free Trade country may have by somewhat cheaper raw material or cheaper labour. Why can a manufacturer in a Protected country produce in larger quantities? Well, it stands to reason that a manufacturer who has a market of 60 million of inhabitants secured to him, who has the advantage of preferential treaties with other countries, and who can whenever he chooses use for any surplus the markets of the Free Trade country, I say such a manufacturer must have a bigger market, a secured market and a continuous market, invaluable points for producing cheaper, than a manufacturer of a Free Trade country. The reasons why producing in larger quantities leads to cheaper production is apparent to us here; but for the purpose of this discussion, I venture to enumerate a few of the most salient arguments. Firstly, in a secure market the outlay of works can generally, from the beginning, be a most efficient one. A manufacturer opening works in a Protected country is sure that, given equal conditions of technical skill and sufficient capital, he could rely upon securing a certain minimum of orders per annum. It is a simple sum to him. He has only got to divide the total absorbing capacity of the country by the number of firms competing in that market, making due allowance for the technical perfection of their respective plants and for the capital invested in each enterprise. It is on the solid basis of this minimum of business and limitation of competition that he erects his works, and develops his engineering and commercial staffs. He capitalises his business, and has a limit to expenditure in tools, patterns and so forth, but if he should make a mistake, if he should overestimate the absorbing capacity of his market he can always fall back on England as a dumping ground for his surplus production, within, of course, certain limits, and then he will soon enter the ranks of profit-earning firms. Secondly, he can standardise or confine his work to specialities. In a country which produces for itself, such as Germany, thought is apt to be moulded in certain forms, and the effect of this is seen in a scientific industry such as electrical engineering to this extent, that there is usually a minimum of divergent theories with the natural effect that fewer clashing systems are developed. This makes it easier to standardise, and this in itself is a great gain to any manufacturer, with a corresponding effect on the price of production. Thirdly, except in a period of depression, which may happen once in a decade, perhaps through influences from without, the manufacturer in a Protected country is sure of a continuity of orders. It stands to reason that a country that must cover its wants from the home producer must keep its workshops filled more regularly. The effect of such regular occupation shows itself in quicker turnover, in the requirement of smaller capital for carrying on the work in proportion to the turnover, in the opportunity of using specialised tools and machinery, in cheaper buying, and breeding greater skill amongst the workpeople and staff, and last, but not least, the expenditure of less men and power per £ output, as well as the offering of greater inducements to workpeople to work harder. We know how workpeople slacken down in their daily output when orders are getting scarce. All these factors again tend to cheapen production, all tend to the making of quick and big profits which attract capital with its purifying and cementing influence of the industries of the country, and these profits seem to be fairly divided between the State, the manufacturer, the workpeople, and the investing public. On the other hand, a man who starts electrical works in England to-day realises that, to a great extent, he is entering on a gamble. It is very easy for him to build his works too large from a dividend point of view, or, again, he may make them too small for the work which may come to him, but it would be a very clever man who could exactly apportion his outlay to the work he could obtain. In this country the science of industrial economics is to a great extent in an anarchical condition. We have no school of thought. Free Trade has produced a condition of intellectual drought. We are too apt to take for our pattern all that is done in other countries whether suitable for our conditions or not. Every manufacturer, small or large, is expected not only to copy the work of every manufacturer in every other country, but even if he sets himself out to attempt this hopeless task it will not help him much unless he can show the man who has the order to give that he has in his works or elsewhere the exact machines which his customer may imagine are indispensable for the fulfilment of the order. I can hardly suppose that the most dogmatic Free Trader would deny that our power to produce as cheaply as Germany under such conditions is possible. We must therefore realise this fundamental and principal fact—that by producing regularly and large quantities, we can produce cheaper, and we are better able to supply our own Colonial and foreign markets. To this I pin my faith. If it were not so the so-called advantages of our geographical position, most-favoured-nation clause, the best transport organisation for shipment to and from abroad would have enabled us to have still kept the lead, but all these advantages failed us one by one as soon as our industrial position was being challenged by our competitors, simply and solely because we cannot under our present conditions produce as cheaply. Every other reason put forward seems mistaking cause and effect. Let us consider what have been the reasons which have been hurled at us during the last five years or so for our relative decline. (1) The principal ones have been the absence of water power in this country. (2) The backwardness of technical education. (3) Lack of inventions. (4) Apathy of British capital. (5) Labour troubles. (6) Commodities are dearer, &c. I will endeavour to treat them seriatim: (1) There was a time when some of us were afraid that the existence of high-water falls might favour some other countries in the race for industrial supremacy, but we have lived long enough to have become convinced that coal at 5s. per ton supplied the whole year through to a power station at the top of a coal mine is not more expensive than any water power with its irregular supply, its great capital expenditure, due in many cases either to difficulties in harnessing the falls or to the necessity for spare plant during some months of the year. (2) We heard a great deal that technical education is the cause of our backwardness. How is it that in the early eighties, for instance, our education was quite good enough to enable us to take the leading place in the world's industrial race? We could not have deteriorated all at once. Some of the electrical engineers who were then leading are still working and struggling along, but we cannot make much headway. My reply is that so long as our education is confined to learning what others are doing for the purpose of making the same things and selling them below their selling price (not necessarily below their producing price), and as long as we neglect the means which would enable us to produce cheaper to get below the cost of production of our competitors our technical education has no incentive to improve, and any amount of technical colleges will not improve our education when the incentive is missing. Let us close the circle and keep out the foreign manufacturer making all we require at home ourselves, and we shall be on the high road to economic perfection. Our manufacturer will then be able to deal effectually with industrial problems as they arise, there will then be the best incentives for the use in any given industry of the best brains. Under such conditions technical education is bound to advance at a rate which was never known before, for the good reason that there will be a better market than ever for intelligence trained to cope with the technics of what will then be a profitable industry. But as things are to-day, why should the foreman of our works, for example, send his boy to Birmingham University? He could afford to do it, but why should he when he sees that a draughtsman, a scientifically trained engineer gets less than the wage of a shop foreman? Let us look at this matter in another light. The latest development in electric railways has reached us partly from Germany, partly from America. Well, it is a fact that in these countries several manufacturers combined some five or six years ago to experiment in electric railway traction. They formed an experimental company with a capital of £100,000. That was a bold, but doubtless a sound enterprise. Why was no such enterprise forthcoming in this country? Is it because we are unenterprising? No, I do not think that can be laid to our charge. Was it for lack of capital? Certainly not. The simple reason was

that under similar conditions an English Syndicate would have had no guarantee that any railway company in this country would have given them an order. It is such opportunities as these which are missing in this country, which do more to foster education, to attract brain, to start new industries, than any amount of preaching. I will give you another proof for the soundness of my argument. There are electrical companies which have been most successful in Germany and America, and who have established large works in this country. These companies had practically unlimited capital, they had at their disposal the best brains and experience available for this industry. From time to time such companies have sent us some of their best men, who have done as good work in this land as they ever did in their own land. but what has been the result? It is no secret that, without exception, the financial results of these enterprises have been anything but satisfactory to the parent companies abroad. Now, if lack of technical education is the cause of our decline, why is it that these branch factories, equipped as they have been with the best technical and commercial men which our competitors can produce, why can they not make adequate profits? I think it is fair argument that no amount of mere technical education will improve our present position. (3) Some people are fond of casting in our teeth that we have not been fruitful in new inventions. It is a fact that nearly every electrical invention originated in this country until 1884 or 1885, but since that time, with the one exception of the steam turbine, almost everything new in electrical engineering has come from abroad. It is perfectly plain that the manufacturer who works in a Protected country under such conditions as I have described has much more chance of meeting with his due financial reward than any manufacturer who has to get along under present conditions in Free Trade England. As a fact, most manufacturers are so proud of their calling that they are, as a rule, only too ready to use all, or the greater part, of their profits for further developments. Now, in America and in Germany the profits secured to manufacturers have rendered funds available for research and experiment which have proved stepping stones to great industrial expansion in both those lands. But while German and American manufacturers have been able to thus step into new and loftier positions, we in England have had to remain below consoling ourselves with recollections of our past industrial supremacy. Thirty years — perhaps twenty-five years—ago, hardly any mechanical invention was thought to be worth consideration unless it came from England. But to-day, after a period of 25 years' defence of Free Trade, hardly any electrical invention is considered worth looking at unless it is first appreciated abroad. After all people are apt to forget that inventions spring from laboratories attached to busy, but not to empty, workshops. Inventions, apart from discoveries which are very rare, are nearly always evolutions. (4) A great deal has been said of late about the influence of capital being always held ready to further industry abroad, while the apathy of the British capitalist, is severely blamed for the backwardness of industry in this land. My experience is that you can always get capital if you can show good dividends. But for the reasons, I think I have made plain, we cannot in this country show equally attractive dividends, and for this reason we are deprived not only of the immediate, but also of the potential, help of capital. In Germany capital helped to directly create industries, as, for example, in electrical engineering, because it was sure of its reward, and over and above this inestimable service capital has helped to regulate output a very important and delicate matter, but this great service would not have been possible, but for what I may term the federating influence of the tariff. It made it worth the while of the capitalist to join hands with the manufacturer, and it also gave capital the right of organising, so to speak, the course of the industry it was befriending. A further valuable result of this nationalisation of industry, for it is nothing less, has been the incentive it has afforded to costly experiments for the application of electricity to any number of allied industries which have enabled electrical engineers of other countries to extend their operations to mining, electro-chemical, iron and marine work, and in many other directions. But, of course, capital would never have run such risks, except with some certainty that in case of success, repeat orders would be there to recoup them for all their outlay. Yes, gentlemen, these conditions which I have explained this evening account for the fact that our mining industry, the oldest in this country and in the world, seems unwilling to electrify a mine without a visit to Dusseldorf. The installation of a gas plant or of an electric railway or telephone sends the buyer abroad simply because our manufacturers have no security that if they create anything new their markets will be secured to them. This is why British capital finds greater profit in financing foreign industrial concerns. This is why the Victoria Falls and other great electrical prizes have gone abroad. (5) We are told that if we have Tariff Reform we shall have more trouble with labour. I cannot agree with that view. As long as there are employers and employés there must be differences of opinion between the two as to the value of labour, whether the employers be private, municipal, or the State. These differences have found expression in slack and in prosperous times. I prefer them to happen in prosperous times for the sake of both parties. The worker, when trained to higher skill of efficiency, has a right to demand more, and the employer has a greater margin to give, and is more eager to give, as he cannot afford, during a time of busy workshops, the emigration to protected countries of the skilled labour such as is going on in such a deplorable manner at present. With regard to labour, it is unhappily true that under a Free Trade system the proportion of skilled labour tends to decrease, while the proportion of unskilled labour increases. But it has been my experience, and I have had unusual opportunities of comparing the relative efficiency of British and foreign labour in the electrical industry, connected as I have been and am with foreign companies which make the same kind of goods as I produce, and I gladly state that British workmen, properly led, are second to none in the world. British labour may be dearer per head, but it is not dearer per pound of output, neither is it dearer per manufactured article. Given proper industrial conditions there is, I am convinced, no country in the globe which could steal a march on us. It is a favourite argument with Free Traders that in protected countries commodities are dearer, but we electrical engineers and manufacturers know that the prime factor in determining cost price is the quantity that can be produced. The following may be a suitable practical illustration:—I am quite satisfied that it does not require a large percentage of duty to secure our market. For instance, if we only had a duty of 10 per cent., foreign competing firms would well understand that that figure could be varied, and in that case they would be placed in the same position of insecurity in our market in which we are to-day. Under such conditions they would probably in organising their works be more careful to avoid over-production. They would not organise for working our market as they do now. Hence, instead of sending us an unknown quantity of foreign products, and for ever depressing our prices, some of these competitors would doubtless start works here, which, of course, would be to the benefit of the working man and the State in general. The manufacturer, on the other hand, would not have any reason to grumble, because he would no longer be liable to be taken at an unfair advantage. The net result would be that we could turn out from our existing works continuously larger quantities securing regular profits, giving regular employment, and, at the same time, be able to reduce our cost of production. Assuming that last year we imported 8 to 10 million incandescent lamps, I am bold enough to say that under a tariff of only 10 per cent. the bulk of those lamps would never have been imported, but would have been manufactured in the existing British workshops, many of which last year were running short time. The cost of production would have been reduced by at least the amount of the duty. Nobody would have been a penny the worse, but the factories would have made some profit and employment would have been larger and more regular, to say nothing of the attendant advantage of a bigger wage fund for distributing among British operatives, which, of course, means an increased power of expenditure in the home market for the benefit of every other industry.

Last, but not least, I will put one question to you. Could our country be equally prosperous and equally secure if it ceased manufacturing altogether—if, in short, we were to buy all we wanted. This may be called an *argumentum ad absurdum*. No doubt it is pushing the Free Trader's argument to its extreme limit, but that is, and nothing less, what the Free Trader maintains. It is possible—nay, likely—that, under such a system, some people provided with capital and well found in experience might grow yet richer. But imagine for a moment the disastrous effect of such conditions on, first, employment, secondly, on the national wealth. This latter point needs little elucidation. Our rich stores of coal, iron, &c, are natural wealth, but of what value would they be to us if we made up our minds to let them lie in the ground? The nation which elected to follow out a Free Trade policy to its logical conclusion would be equally annihilating its powers of exchange. Grave as such a condition would be the evil would not stop there. A nation which deliberately stopped manufacturing—that is, using its material resources to the best effect—would be taking the shortest and directest route to national suicide; for such a policy would, in the highest degree, tend to stunt all those qualities which lie at the basis of national efficiency, self-reliance, perseverance, the perceptive and reflective faculties would each and all be weakened. How would a great Empire like ours exist without dockyards and arsenals?—but the building of Dreadnoughts and the making of 100-ton guns is only one expression of the manufacturing genius which is the basis of civilisation. Having said so much in favour of Protection for the electrical industry, I would like to add that it would sound peculiar that I am at heart a believer in Free Trade, but what I mean by Free Trade is not the spurious type that obtains in England to-day but Free Trade amongst all nations, and this might even now be brought about by the erection of a tariff barrier as impregnable as those which protect the preserves of our rivals. We have grown so strong through the inherent advantages which exist in our Empire, that the absurdity of running Tariff walls against us would become apparent, with the results that trade would become free in the best sense. Given equal conditions, neither British brain nor British muscle would need artificial bolstering up by Tariff.

One word more, those who come as I do into personal daily contact with many of the manufacturers of Germany, France and America, and discussed with them international commercial relations, know full well that our competitors fully recognise it as a natural and necessary step that we should protect our industries. Now, as so great a portion of the world is still undeveloped and so many industries are in a state of germination and growth, there is still time to put our houses in order, and march side by side with our German, French and American friends in the cause of civilisation. If we hesitate, if we delay, we encourage them to increase their factories as well as their reliance upon the British market. So the day may come when any attempt to do what we can do now will be regarded as a direct disturbance of their national and vested interests, which will be correspondingly resented.

Thus it is my view that in the best interests of the country, as well as the electrical industry, manufacturers and workers should be protected now while it can be done with the goodwill of the nations.

THE DIFFICULTY OF THE CONSULTING ENGINEER.

In few professions does so much misapprehension exist as in engineering with regard to its prospects and purposes, and in no section of it is so much calumny disseminated as in connection with the consultants' branch. We are by this time unfortunately reconciled to stokers designating themselves as engineers; to plumbers who most brazenly advertise as electrical engineers because, perchance, they feel capable of running two wires on a wall to an electric bell. We recognise that engineers have no status—all the raging of the younger members of the profession, and all the calm and dignified protests of the reverend signors who occasionally add to the gaiety of nations at the meetings of a certain Institution, cannot alter that, for we have drifted too far. But if we cannot protect ourselves, we at least have a duty to the public at large, on whom, to some extent, we are dependent for our existence, and it is really time that some practical steps were taken to prevent the indiscriminate use of the term consulting engineer, which, unless checked, will rapidly become a menace to the whole profession.

When a man finds himself in need of a doctor, he has no difficulty in making his choice, since he is aware that medical men cannot practice as such without proper qualifications, but when the same man requires some engineering work to be carried out he is at once in a quandary. He may have heard from friends of pseudo-consulting engineers, probably mere non-technical agents of certain specialities, with which all large towns abound, who have undertaken work and landed their clients into difficulties; probably he will likewise know of old consultants of long standing, whose fees he imagines will be far too high in proportion to the work to be done. Unless, therefore, he numbers a consulting engineer among his personal friends, he will, as likely as not, eschew the whole of them, confidingly place himself in the hands of a large manufacturing firm, and ask them to do the whole business. The very natural result is that, without in any way acting dishonestly, the manufacturers find that more plant is necessary than was anticipated, and though the work may be properly carried out, the expense involved is considerably in excess of what might have been sufficient had a third disinterested party supervised the whole scheme.

Provided the consulting engineer is a man to be relied upon, there is no question as to the justification of his employment, and this is so well known that there is no hesitation on the part of the buying public in retaining his services so long as his standing is undeniable and his fees within the bounds of reason, but until the possibility of being badly let down is dispelled there will naturally be some doubt—which doubt readily reflects itself in all directions in the industry. A consulting engineer serves as a pivot for any scheme, however small or large, and allows of complete concentration of responsibility. Only a very insignificant proportion of engineering work consists of straightforward propositions, in which it can be said that the job can be carried out in one way only. There are almost always a dozen different methods of accomplishing practically the same thing, all having advantages and disadvantages, which need to be carefully analysed, in order to provide the most workable and economical arrangement. A contracting firm has not the time to realise all these alternatives, and even if it does, it is asking too much of human nature to expect the cheapest to be recommended, and it is seldom that the difference in price between the scheme which a consulting engineer would advise, and that which a contracting firm, with as much machinery to sell as possible, would desire, is less than 5 per cent. of the total cost which is the usual fee of the consultant. In other words, the latter is a sound commercial investment besides relieving the client of entire responsibility, which can never be the case when dealing direct with a manufacturer, owing to the impossibility of formulating specifications, which cannot be set aside if it comes to the pinch. For, without in the least disparaging the honour of the large manufacturing firms, it must be admitted that when it comes to a question of losing money, they will take the fullest advantage of all that they are legally, if not ethically, entitled to.

The integrity of the consulting engineer should be absolutely beyond doubt, since the possibilities of underhand dealing without any likelihood of discovery are almost boundless, and this is a most urgent reason why the standing of consultants should be more definitely defined than any other members of the profession, and their qualifications more rigidly scrutinised. The solution of the difficulty and the weeding out of the undesirables does not seem possible by the mere formulation of rules regarding professional etiquette as has been done by the Institution of Civil Engineers, since such regulations only bind the scrupulous, whose sense of honour is already sufficient for them, while it gains no hold whatsoever on the unscrupulous. The public apparently cannot be wholly relied upon to discriminate between worthy and worthless qualifications, and even when it does so, the undercutting of fees, now prevalent in some quarters, has a serious effect upon the better men, and this practice is one which ought to be suppressed at all costs.

At present it must be admitted that the case seems somewhat hopeless, and the possibilities of reform small. It is too much to expect the matter to be settled on a legal basis, and allow the term consulting engineer to be employed only under certain stringent conditions, with heavy liabilities in the event of its misuse, but in no other way does it seem feasible to put a check on those individuals who are now exercising a serious and detrimental effect on the profession. The training of a capable consulting engineer is even more expensive, and the earlier work less remunerative than that in other branches of engineering, and it is unjust, to say the least of it, that not only should unqualified men take business out of his hands, but should by their unprincipled actions cast a stigma on the whole profession.—A. P. C.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Whitehaven Colliery Disaster.

I have no doubt the majority of your readers have heard or read with a considerable amount of feeling and horror, of the terrible catastrophe to humanity which has just occurred at Whitehaven Collieries, and a still deeper feeling has permeated us—or most of us—when we read of the Home Office expert's decision, giving instructions to have the affected part of the mine isolated from the outer world. Now, I do not for one moment disagree with that gentleman's decision, which, we all understand, was to save further damage to property and to prevent further loss of life by futile efforts on the part of the splendid band of heroes—over 100, I believe—who are ready even now, at this late hour, to risk their lives—not in an attempt to save their comrades, but just to satisfy themselves that their comrades are really dead.

Now, Sir, my point is this: How is it really possible, under the circumstances, for anyone to say conscientiously that these men were dead? There was no certainty of any description to come to that definite conclusion. But they did come to it.

Now I have a suggestion I would like to make (with your kind permission) with a view to making it possible to arrive at something conclusive in a case of this kind, and I often wonder it has not been adopted before, because we have been having quite a lot of these or similar accidents of late. My suggestion is this: Why does not the Board of Trade or Home Office make it compulsory for mine owners to have a system of telephones installed whereby it would be possible, as in the present case, to keep up a continual communication with those cut off, and to make arrangements or suggestions to those imprisoned as to what could best be done to assist the band of rescuers? The imprisoned men could also keep those in the outer world

informed (their friends and relations) *re* actual events happening in the mine while the work of rescue was proceeding.

Some people might say that it would be impossible to keep telephones in working order owing to damp atmospheric conditions, &c., but I know for a fact that there are several manufacturers of repute who make a speciality of this class of instrument, namely, the Western Electric Co., the British L.M. Ericsson Co., and the General Electric Co., and instruments made by the above-named firms are installed and working splendidly in nearly all the mines in South Africa and Australia. The instruments are enclosed in cast-iron cases, which are both water and air-tight, and can be used as portable or fixed telephones. The cable would be lead-covered and run in ducts along the main road to a water-tight junction box at a certain point, then branched off to the different workings to a watertight wall-plug or instrument. One leading man could be told off to take charge of the instrument in each working, and he could ring up the office at the pithead at specified intervals to ensure that everything was O.K. at the respective posts or workings. If the attendant did not get any signal from one or all of the workings at the time specified, he could proceed to ring them up. If in the case of a portable instrument installation, there could be an extension bell bridged across the line. Then, if he got no answer to repeated ringing or calling, he could proceed to test the line from a test board or panel, which would have a low reading voltmeter of, say, 4 volts range, the coils of which will measure about 700 ohms, more or less. A little practice would show whether the deflection noticed was due to the resistance of the line and ringers, or to trouble on the line caused by a short-circuit or disconnection.

Of course, I am referring to a magneto system ; and voltmeter, line to be tested, and ringer, would all be in series. If it were a central-battery installation, the voltmeter would have a higher range to correspond with the higher voltage incidental to that system. If the line tested O.K., the attendant could draw his own conclusions accordingly, and report the matter.

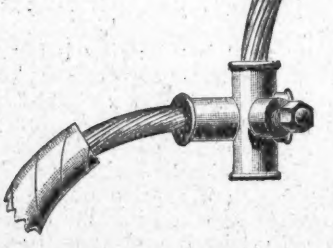
In conclusion, I sincerely hope that some of our private members in Parliament will take this matter up and bring it before the Department concerned, if for nothing else but a sense of duty to humanity, considering the widespread expressions of sympathy expressed in these accidents from Royalty downwards.

Maque.

May 16th, 1910.

A Unique Cable Joint.

The emergency expedients one has to resort to at times are not infrequently of a curious nature. Especially is this so on mains work. But perhaps a "dodge" used by one of



the mains fraternity a short time ago is, in its way, unique.

A "break" fault had developed on a heavily-loaded feeder on top evening load. Fortunately, the trouble was easily located, the extent of the damage being confined to an unsweated thimble-lug joint. No jointer or tools being at hand, it looked very much like having "juice" off for a considerable length of time until the necessary commodities were available. However, fortune was on the side of the mains man. Near by, some purely "mechanical" repairs had been going on, and the eagle eye of the super alighted on a heap of portable drilling tackle. Almost as quickly as the inspiration had seized him the drilling jig was dismembered, and the universal joint head-piece slipped off and quickly transferred to the erring cable.

Thus was the reputation of the department saved. The accompanying sketch shows the arrangement ; unfortunately, circumstances precluded any possibility of a photo being obtained. The joint, it may be said, although very temporary, was thoroughly sound both mechanically and electrically, and would have stood for all time.

Sale.

The Election of Council of the I.E.E.

Having received a circular and letter soliciting my vote and interest in support of Mr. H. Faraday Proctor at the above election, I have a few remarks to make thereon.

As one who has known Mr. Proctor for close on 20 years, also served under him, I believe that he would make a most excellent Member of Council, having special qualifications in this direction as judged by the exceptionally good work he has done in connection with the M.E.A., and would undoubtedly very soon justify his election, but at the same time I do not either admire or even countenance the manner in which his nomination, &c., has been engineered.

I should like to know since when the circularised members of the Institution have been deemed incapable of thinking for themselves. The select and apparently self-elected coterie of gentlemen in the West not only take it upon themselves to put forward a nominee for election, which, up to this stage, is in perfect order, but they also proceed to tell us whom we should vote for in regard to the other Members proposed by the Council of the I.E.E., and who should be dropped. This, to my mind, is not only rank impertinence, but absolutely the most flaring piece of inconsistency they could have put to paper. I take it that the main grievance of this select body of gentlemen down West is that the Council of the I.E.E. have hitherto taken unto themselves the nomination of members of the Council without reference to the general body of the Members of the Institution, yet they do not hesitate to dictate to—and, to my mind, insult the intelligence of—those Members whom they have thought fit to circularise. The little party in the West have evidently not only forgotten themselves and displayed bad taste, but they have gone further, and been carried away by their enthusiasm and exaggerated opinion of their own ideas.

J. H. Cawthra,
Borough Electrical Engineer.

South Shields, *May 23rd*, 1910.

[We are pleased to note that our correspondent agrees with the views we put forward in our leading article last week, which apparently he has not seen.—Eds. E.R]

I will not make any comment upon the fact that there is an election this year, but I do wish to say how surprised I am that on the ballot-paper the instructions are, to vote for not more than five candidates. It is left quite open to a member to vote for any less number ; and as this letter will not be published until after the result is known, I may remind members that, if it is desired to advance particularly the candidature of Mr. X. Z. or Mr. A. B., all the other candidates may be struck out, and their totals prevented from increasing by the member's vote. I have protested against this in Local Section elections, but I thought headquarters would know better. It should have been compulsory to vote for five, and not less ; and, of course, as was actually the case, plumping five votes for one candidate should be prohibited.

A. K.

Rawtenstall Tramways.—The T.C. has approved the plans, specifications and estimates in connection with the proposed electric tramways along Whitewell Valley, and has decided that tenders be advertised for.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Universal Shunt: Rymer-Jones Improved Pattern.

This Universal shunt is constructed on precisely the same principle as that described and illustrated in the ELECTRICAL REVIEW of March 25th, 1904, page 521. A decided advantage will, however, be noticed in the greater facility which the improved pattern offers for reading the shunt values. Instead of the contact arms pointing to these values, indicated by figures engraved near each metal stud (as in the old pattern), graduated circular disks are now fitted to the axles of both the slide and the vernier parts of the instrument so as to move round with their respective contact arms when their milled-head knobs K_s, K_v are being turned by hand.

This modification permits the value of the shunt resistance—included in the main circuit between terminals T and T G—to be always read at the adjacent fixed points marked *s* and *v*.

For example:—If the full reading be (say) 2,436, the first two figures (24) are read at the fixed index line *s*, and the last two figures (36) at the index line *v*.

Moreover, as these circular scales are placed immediately below the glass covers, they get the maximum illumination.

The instrument measures only 13 in. × 7 in. × 3½ in. deep, so that it can easily be additionally insulated, and is especially suitable for use on board ship or in cable-huts, where instrument space is limited. A Universal shunt constructed on this principle has the advantage that only three contacts are necessary; and as these are made by platinum rubbing on gold, they keep themselves clean by friction. This principle also permits of the retention of the simple formula $\frac{G\,S}{G+S}$ for the combined resistance of the shunt and galvanometer resistances in parallel as given in the modified form.

Resistance in galvanometer circuit as shunted $= \frac{[G+(10{,}000-n)]n}{10{,}000+G}$

where *n* is the shunt reading.

This shunt is made by the INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS CO. at their Silvertown factory, where it has been in use for the last 14 years.

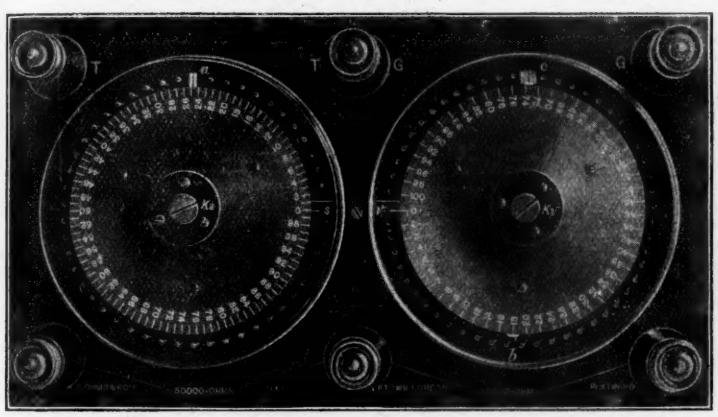


FIG. 1.—RYMER-JONES UNIVERSAL SHUNT.

The "Klymax" Panel Switch.

From MESSRS. LUNDBERG, of Pioneer Electrical Works, Liverpool Road, N., we have received a sample two-way "Klymax" panel switch for five amperes, which we illustrate below, with the porcelain cell broken to show the internal construction.

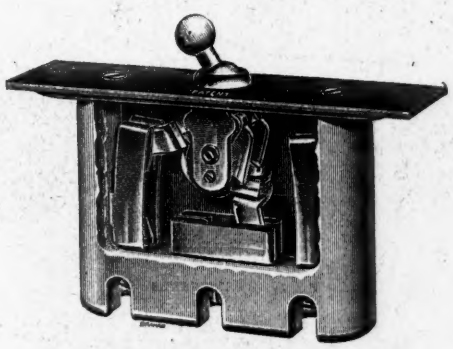


FIG. 2.—TWO-WAY KLYMAX PANEL SWITCH.

The switch movement, with knife blade contact arms and double-contact springs, is enclosed in a narrow porcelain cell, with a brass (or other) front plate, measuring 3$\frac{1}{16}$ in. × 1 in., and is intended for flush work.

The design allows of several switches being grouped into a small space with one front plate to serve all; when double-pole and intermediate switches are required, these can be obtained by coupling the knobs of two single or two-way switches respectively.

Two-pin wall connections of various gauges can also be arranged on the same porcelain parts, enabling combination sets to be made up in minimum sizes.

"Osram" Lamps.

The GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., are placing on the market a new "Osram" lamp of tubular shape, which they are making for from 100 to 135 volts in 16 C.P. only. They anticipate a considerable demand for this new shape of lamp, as it particularly adapts itself to many popular fittings now in vogue.

FIG. 3.—TUBULAR OSRAM LAMP.

Unipivot Testing Sets.

Some years ago we described the ingenious device invented by MR. ROBERT W. PAUL, of New Southgate, N., by which a great advance was effected in the construction of portable moving-coil galvanometers. The instrument has proved so successful that the inventor has been led to develop it, and has now brought out a direct-reading Unipivot universal testing set, which covers a remarkably wide range of measurements.

FIG. 4.—UNIPIVOT UNIVERSAL TESTING SET.

The accompanying illustration, fig. 4, shows the set with cover removed, and fig. 5 is a diagram of the internal connections.

The great sensitiveness of the instrument enables it to be used alone as a testing galvanometer, having a uniform scale reading from 0 to 120 microamperes. A "universal shunt" of 600 ohms is provided, giving seven shunt powers, and a resistance of 20,000 ohms,

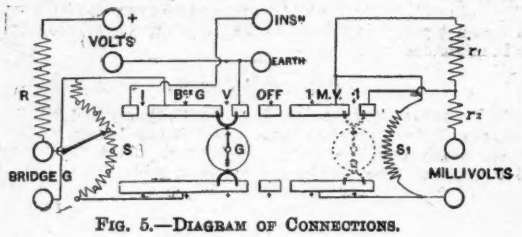


FIG. 5.—DIAGRAM OF CONNECTIONS.

to stand pressures up to 600 volts. Thus the instrument can be used as a voltmeter, reading directly any pressure from ·0001 to 600 volts in nine ranges, and by adding external volt-boxes the range may be increased.

Insulation resistances may be read off by first measuring the testing pressure with the connections as shown above in full lines, and then measuring the current flowing through the insulation with the connections at 1, the change being effected by means of a double-pole switch, shown developed in the diagram. With the aid of external shunts, the instrument is converted into an ammeter, and measures any current up to 120 amperes, with a lower limit of 1 microampere. For this purpose Mr. Paul has devised a new form of standard shunt, as shown in fig. 6; in this the resistance consists of a manganin tube, slotted for ventilation, having heavy terminals, with an ingenious slotted screw connection, which is capable of firmly gripping conductors of very different sizes without fear of shearing off the finer ones or heating with the larger. The potential leads plug into tapered holes, and the sides of the terminals are so shaped that the current stream lines are parallel at these points. As the resistance of the milli-voltmeter is very high (100 or 1,000 ohms), the resistance of the potential leads is generally negligible, even if the shunt is at a considerable distance from the set. By means of the double-pole switch the connections can be rapidly changed over to measure pressure and current in rapid sequence, thus enabling power measurements to be made. Small resistances, from ·00001 to 10 ohms, may be measured by the fall of potential method, in series with one of the standard shunts, which are all adjusted to round figures; and thermo-couples are supplied to enable the instrument to be used for measuring temperatures. The microammeter can also be used as a ballistic galvanometer, 100 microcoulombs giving a complete throw across the scale. Wheatstone bridge measurements are made by connecting the bridge to the terminals on the left, which also provide for fault localising by the Murray or Varley tests.

It will be seen that a remarkably wide range of utility is covered by this instrument; moreover, to facilitate its use, a handy little book of instructions has been compiled by Mr. Paul for issue with each set, showing clearly how the various measurements and tests are carried out, and giving actual examples of localisation of faults on mains, the information in some cases being new and original. A larger set can be supplied, having a higher resistance; when used as a voltmeter, the resistance is 100,000 ohms, and insulation resistances up to 3,000 megohms can be directly measured. This set also has a translucent dial lighted from below by a two-volt lamp.

The instrument needs no levelling, owing to the point of suspension being at the centre of gravity of the moving system;

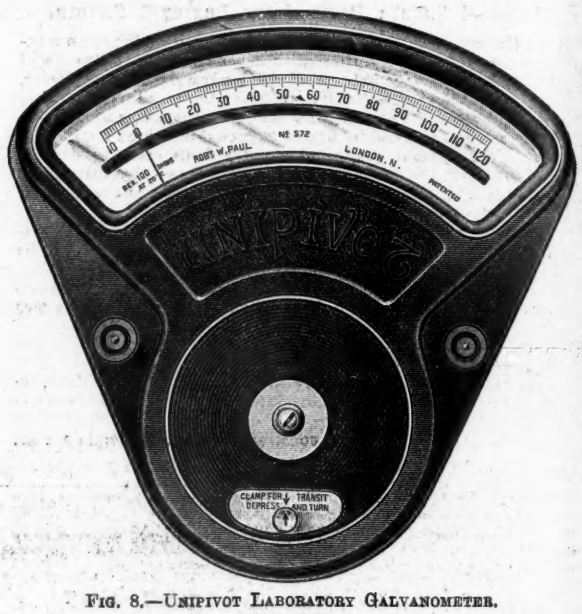


FIG. 8.—UNIPIVOT LABORATORY GALVANOMETER.

this is illustrated in fig. 7, which shows the spherical iron core and the circular coil, which is pivoted at the centre of the core. Stability is provided by the controlling hair-spring. When the case is closed, the pivot is automatically lifted off the jewel, so that it cannot possibly be damaged in transit.

Fig. 8 shows a laboratory pattern of Unipivot galvanometer capable of reading to one ten-millionth of an ampere; the case is of aluminium. This instrument is designed for high sensitivity and extreme accuracy, and can, of course, be used for a great variety of measurements. It will be noted that the scale is carried back past zero for 10 divisions, a great convenience in many cases.

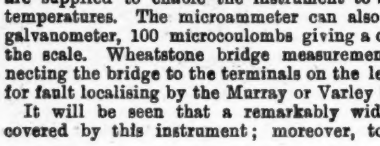
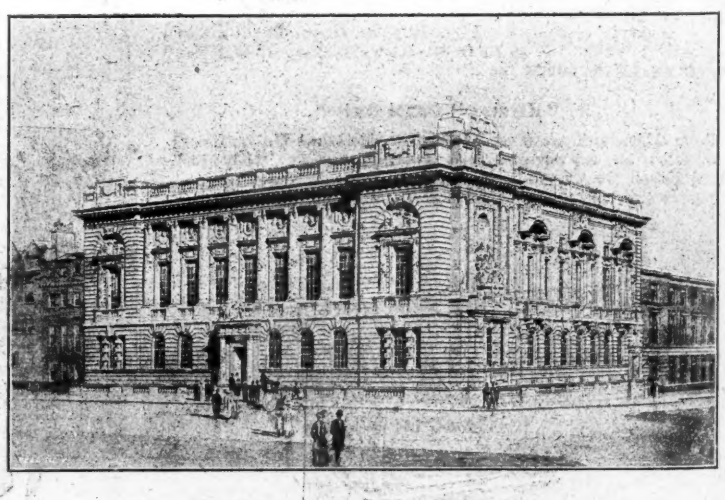


FIG. 6.—TUBULAR SHUNT.

FIG. 7.—DETAIL OF COIL, SHOWING PIVOT.

INSTITUTION OF CIVIL ENGINEERS' NEW BUILDING.

WE have received from the Secretary of the Institution of Civil Engineers a copy of the elevation and plans of the new building, which will be situated at the corner of Great George Street and Princes Street. The design is by Mr. James Miller, F.R.I.B.A., and is strongly reminiscent of the present building in elevation; the area occupied is about 21,000 sq. ft., and the accommodation provided is much



THE INSTITUTION OF CIVIL ENGINEERS.

more extensive than that of the existing building. The principal rooms will be the Lecture Theatre, the Great Hall and the main Library, on the first floor; there will be an additional Library on the second floor, as well as a writing and smoking room; and on the ground floor, besides the General Offices, Council and Committee Rooms, there will be two reading rooms. The designs appear to be in every way worthy of the importance and prestige of the premier engineering society of the world, and will admirably serve the comfort and convenience of its members and their guests.

The Lecture Theatre has a floor area of about 43 × 63 ft., and might, perhaps, have been larger with advantage. The Great Hall is about 42 × 98 ft., and the Library 28 × 112 ft.

We reproduce a view of the building as seen from St. James's Park.

LEGAL.

Cutting off Current—Corporation's Powers.

Lord Cullen, in the Bill Chamber of the Court of Session, in Edinburgh, heard counsel on an application at the instance of the Aberdeen Station Hotel Co., in liquidation, to have respondents, the Corporation of Aberdeen, interdicted from cutting off the supply of electrical energy supplied by them to the hotel. The respondents had threatened to stop the supply because the company was in arrears with the payment of the rate.

For the complainants, Mr. C. Stewart said the Corporation were seeking to secure a preference over the other creditors of the company, although they were an unsecured creditor. Counsel submitted that the note should be passed for the trial of the case, and that interim interdict should be granted.

Mr. Chree, on behalf of the respondents, said the proposal by the complainers was to interdict his clients from taking a statutory remedy for the recovery of the rate. Sec. 23 of the Aberdeen Corporation Act, 1907, gave the respondents power to cut off the supply to anyone in arrears. It was not a matter of controversy that the complainers were in arrears, because the usual half-yearly account entered in May had not been paid. Counsel further pointed out that a liquidator was not in the same position as a trustee in bankruptcy, because nothing was vested in a liquidator, who merely managed for the company, which consented to occupy the premises in his person. The respondents did not object to the note being passed, but they did object to interim interdict being granted except on consignation of the amount due, which was £125.

His Lordship said there was an obligation on the Corporation to supply electricity so long as the consumer was not in arrear. The moment the consumer got into arrear, the obligation fell. His Lordship, therefore, refused the note.

Car Conductor Sentenced.

Last week a car conductor in the employment of the Paisley and District Tramway Co. was charged with having falsely represented to a passenger that a ticket which was not valid would carry him from Renfrew to Kilbarchan, thus inducing said passenger to give him 4d., which he appropriated to his own use. Accused was convicted and fined 10s., or seven days.

La Societe Industrielle des Telephones v. Nussbaum.

In the King's Bench Division on Tuesday, Mr. Justice Grantham and a special jury heard this case, which was an action to recover £782, balance of money received by the defendant for the plaintiffs as their agents. The debt was practically admitted, and the defendant paid into Court the sum of £600, the amount disclosed by the accounts, but he counterclaimed in respect of breach of contract and loss of commission on business which he failed to secure owing to the conduct of the plaintiffs. Under these circumstances, the defendant took the position of plaintiff and sought to prove his counterclaim.

Mr. Lewis Thomas, K.C., who appeared for the defendant, said that the plaintiff company had not carried out their work according to contract or to time, in consequence of which the defendant had suffered damage by the loss of orders. In one case the contract was that English pig lead should be used for covering the cables, but it was found that Spanish lead was used. The plaintiffs, however, protested that while admitting the use of the Spanish lead, they derived no advantage from it. They attributed the substitution to the difficulty in obtaining supplies of English lead. Some of the telephone wires had to go underground in conduits and others overhead. In regard to the former, it was found that the cables had too large a diameter, and in regard to the latter some of them were too heavy and did not comply with the London County Council's regulations, which were that no aerial cable should exceed 1 lb. in weight per foot. There were also constant complaints of delay in delivery, and in consequence the National Telephone Co. declined to place a second order until the first was executed. Thus the defendant lost much business, and a large amount of commission which he would otherwise have received. For this he claimed, together with money spent by him for the company and expenses incurred owing to their failure to complete orders to time.

Mr. Neil Nussbaum, the defendant, said he had been in business in England for 25 years. He had been engaged in civil engineering, and sold electric appliances. He had, since he first did business with the plaintiff company, worked for them only, and had done business to the extent of about 1,000,000 fr. a year. There was a written agreement in 1891 with the plaintiff's predecessors, and he went on upon the terms of the old agreement. He had offices on Ludgate Hill, and had a salary of £120 a year and commission. He had been in touch with the National Telephone Co. for years, and since 1904 he was in a position to place their orders where he liked. He introduced the National Telephone Co. to the plaintiffs, and the result of the introduction was an arrangement by which the plaintiff company should get the orders, they having stated that they would be able to deliver three miles of cable per week. Mr. Leoté, a gentleman connected with the company, said that they were getting new plant for india-rubber-covered cables. He placed a large amount of orders with them, but they did not execute them to time, and the result was that he could not get orders where he otherwise would have done so. If they had carried out their contracts to time, his commission upon the orders would have amounted to £1,500 a year, but he did not get more than half the amount which he should have done, owing to the plaintiffs' unpunctuality, and he claimed for his lost commission. On no single occasion were the goods delivered by the plaintiffs in time, and any number of complaints were made by the National Telephone Co. in consequence. Those complaints were forwarded to the plaintiffs. The first complaint he had was in August, 1905, about the English lead, and a number of other complaints were made subsequently.

On Wednesday, Mr. Nussbaum, the defendant, was recalled and further examined by Mr. Lewis Thomas in support of his counterclaim. He detailed a number of complaints which he had had occasion to make to the plaintiff company in respect of the manner in which they had carried out the orders which he had forwarded to them, and said that he was requested by Mr. Leoté, of the French company, to retain his agency until the current contracts were finished. He consented, and stated that there would have to be an alteration in the terms of the arrangement after that. As late as March and April of last year the company had communicated with him as their agent. They wrote to him with reference to orders which had been executed for telephone fittings.

In cross-examination by Mr. Montagu Lush, K.C., Witness said that he was a civil engineer and a member of the Institution of Electrical Engineers. He was not acting now, because he had been "hung up" for the past two years with the affairs in dispute. He could not do other business because he was still engaged with the plaintiffs. He had, however, been in negotiation with several firms with a view to business, but they all told him first to finish his affairs with the plaintiffs. He had been doing business with the Société before 1890. He first bought from them telephones as a merchant, which he sent out to Australia. From 1891 to October, 1908, he only did business with the Société Generale and the Société Industrielle. It was one of the terms of his engagement with the French company that he should remit all money received by him for the company, within a week or two, and he continued to do so down to 1908. He had in his employ a clerk who falsified his accounts and forged an endorsement to a cheque, and that threw his accounts into some confusion. The difficulty which arose with regard to the French company's accounts was not due to that, but to the confusion into which the company's affairs had got. The plaintiffs ought to have found out that this clerk was a forger.

Mr. Lush: Why did you keep the £600 for months when the contract said that you should remit all money at once.—I kept it as a guarantee. The plaintiffs had broken the contracts several times, and I could not get any satisfaction from them, so I thought I ought to have a guarantee that they would finish the contract which was then running. The £600 was paid into the bank, and I told them that I would pay it into Court, which I did.

Was not your sole reason for retaining the £600 because your solicitor had advised you to do so in order to force the French company to bring their action in the English Courts?—That is so.

Mr. Dudley Stuart, an engineer of the National Telephone Co., was called, and gave evidence as to the orders which had been given through the defendant to the plaintiff company, and the manner in which they had been executed.

This closed the defendant's case, when his Lordship invited counsel to consult him in his private room. The consultation lasted over an hour, and in the result Mr. Lush, on returning into court, thanked his Lordship for the opportunity which he had afforded the parties of arriving at a satisfactory arrangement.

His Lordship said he was glad the parties concerned had come to an amicable settlement, under which a portion of the £600 paid into court would be paid out to the defendant. The plaintiffs were naturally incensed, but they had acted in a straightforward manner, and the defendant had unfortunately acted hastily. The letters which had passed convinced him that the defendant was an honest man, and that the plaintiffs were acting honourably by him. He thought the plaintiffs had acted fairly and honourably in the way they had treated the defendant, and that the defendant was wise in accepting the settlement.

The jury were then discharged.

BUSINESS NOTES.

Turkish Tramway Concession.—It is announced that the Turkish Minister of Public Works has instituted a competition for a concession to establish and work a new network of underground and surface electric tramways in the suburbs of Constantinople. The proposed tramways are to be constructed in such a way as in no way to prejudice the rights of the existing Constantinople Tramways Co. The latter undertaking, it will be recalled, is now controlled by the Ottoman Union, which is composed of French, German and Swiss financial institutions and electrical firms, and which proposes to convert the lines to electric traction.

British Traders' Concentration on Turkey.—In commenting upon the arguments of Sir Adam Block, for Greater British concentration in endeavouring to secure trade in Turkey (see ELECTRICAL REVIEW, April 15th, 1910, page 578), the *Chamber of Commerce Journal* says:—"We strongly commend the above suggestion to the consideration of merchants and manufacturers. It is true that combinations of this kind have not hitherto been altogether favourably regarded in this country. We are prone to recall with pride that British trade has been built up and multiplied almost entirely by individual effort. But it must be remembered that every year competition grows keener and keener, and new methods of gaining and holding trade are being successfully adopted by our competitors. In other words, the times are changing and it may be wise to change with the times."

For Sale.—Clacton U.D.C. is offering several gas engines, dynamos, tanks, switchboards, &c., for sale. See our advertisement pages to-day.

Private Meetings.—DAVEY ELECTRIC CO., LTD., 112, Whitechapel, Liverpool.—A meeting of the creditors was held recently, at the offices of the company, Whitechapel, Liverpool. It was reported that the shareholders had already passed a resolution to the effect that the company could not continue to trade by reason of its liabilities, and that it was advisable that the concern should be wound up voluntarily. At the same meeting the shareholders appointed Mr. Joseph Andrews, of North John Street, Liverpool, to act as the voluntary liquidator of the company. A statement of affairs was now presented by the liquidator, which showed liabilities of £2,564, all of which were due to unsecured creditors. The assets were estimated to realise £2,108, from which had to be deducted £43 for the claims of preferred creditors, leaving net assets of £2,064, or a deficiency as regarded the unsecured creditors of £499. The assets were as follows:—Cash at bank, £75; stock-in-trade at cost, £777; trade fixtures, fittings, &c., at cost, £130, valued at £29; electric light deposit, £6; book debts (good), £107; bad and doubtful book debts, £144, estimated to realise £50; and unpaid calls, £140, expected to produce £100. It was stated that with the exception of loans amounting to £450, the whole of the unsecured liabilities were in respect of trade creditors' claims. Mr. George Harley, solicitor, of Liverpool, was a cash creditor for £300, money lent in August of last year. Mr. M. Davey, one of the directors of the company, was also a cash creditor for £150, money advanced in September last. On these advances the company had agreed to pay interest at the rate of 5 per cent. No repayments had been made. The premises were held on a lease which had four years to run at a rental of £100 per annum, and it was admitted that there might be a contingent liability in this direction. For the purposes of the meeting, the stock had been taken in detail. The company was only formed in May of last year, with a nominal capital of £2,000, divided into shares of the face value of £1 each. The issued capital of the company was £1,100, of which all but £150 had been fully paid up. No proper deficiency account was presented. The liquidator stated that he was previously the secretary of the company. Since its inception the company had done a turnover of approximately £3,792, upon which it was estimated that a gross profit at the rate of 25 per cent. was made. The expenses during the same period had totalled £1,300, the principal items being wages and salaries, £563; travelling expenses, £210; rent and taxes, £140; and sundry expenses, £130. It was pointed out that assuming the figures given by the liquidator to be correct, there was a loss on the trading of about £400, which still left a considerable sum to be accounted for. The company possessed two directors, neither of whom had drawn anything in respect of his services. A lengthy discussion ensued, and eventually it was resolved that application should be made to the Court for the appointment of Mr. Charles Turner, of Messrs. Poppleton, Appleby & Turner, chartered accountants, Sheffield, to act as joint liquidator of the company. A committee of inspection was also appointed, consisting of the representatives of the following:—Messrs. Siemens Bros. & Co., creditors for £1,100; Messrs. Barlow and Co., Manchester, creditors for £80; and Messrs. William Rickard, Ltd., Derby, creditors for £15.

Dissolutions and Liquidations.—G. NICHOLLS & Co., ironmongers and electric fitters, Goldsmith Avenue, Portsmouth.—Messrs. J. D. McCarthy, J. H. McCarthy and G. H. Nicholls have dissolved partnership. Debts will be attended to by the Messrs. McCarthy.

RICHARDSON & CARLMARK, electrical engineers and electroplaters, High Street, West Bromwich.—Messrs. F. W. Richardson and J. D. Carlmark have dissolved partnership.

PHOSPHOR BRONZE CO., LTD, Southwark.—June 7th is the last day for the receipt of proofs for intended dividend by the liquidator, Mr. S. P. Child, 8, Frederick's Place, Old Jewry, E.C.

LEPEL WIRELESS SYNDICATE, LTD.—A meeting of creditors is to be held at the Cecil Chambers (West), Strand, W.C., on May 26th.

Catalogues and Lists.—MESSRS. C. E. LUGARD & Co., Chester.—Twelve-page booklet (No. 1) containing an illustrated description of the S.M. electro-magnetic drive for application to rolling mills, transmission, &c. Tabulated standard dimensions and weights of these clutches are given.

THE EDISON AND SWAN UNITED ELECTRIC LIGHT CO., LTD., 36 and 37, Queen Street, London, E.C.—Twenty-eight-page pamphlet—the present season's Electric Fan List—wherein are given particulars, with illustrations and prices, of a variety of electric fans for ceiling, desk, port-hole, punkah, train and other service.

MR. G. WUTHRICH, Oswaldestre House, Norfolk Street, London, W.C.—Illustrated list briefly describing, also tabulating sizes, speeds, weights and prices of Oerlikon fans and ventilators for single-phase and direct current.

CROMIL ENGINEERING CO., Northern Assurance Buildings, Newcastle-on-Tyne.—Postal card describing their system of lubricating engine cylinders with graphite.

MESSRS. C. A. VANDERVELL & Co., Warple Way, Acton Vale, London, W.—New catalogue of convenient size and nicely produced, giving illustrations and particulars of a variety of electric fans and punkahs and small electric motors—a now important department of their business. Among the fans shown are those suitable for vessels for all classes, also special types (with automatic shutters) for ventilating motor houses, and ceiling fans, or punkahs for tropical use. Lists issued later can easily be inserted.

MR. ED. BRAND, 472, Moss Lane East, Manchester.—Illustrated price leaflets relating to special gauges for wire drawers, and describing new multiple continuous wire drawing machines for fine sizes of wire in copper, brass, &c.

THE BURROUGHS ADDING MACHINE, LTD., 65, High Holborn, W.C.—Folding list describing their adding machine, which is operated by hand or by electric power, and illustrating the manner of working.

Book Notices.—"*Journal* of the Institution of Electrical Engineers."—The issue for April, 1910, contains the following papers:—"The German Electrical Industry," by L. J. Lepine and A. R. Stelling; "Quantitative Measurements in Radiotelegraphy," by Prof. J. A. Fleming; "Efficiency of Short-Spark Methods of Generating Electrical Oscillations," by Dr. W. H. Eccles and A. J. Makower: "Telephones," by L. E. Wilson; "High-Tension Transmission on Overhead Lines," by Dr. E. W. Marchant and E. A. Watson; "An Improved Point Controller for Tramways," by J. P. Tierney; "Continuous-Current Boosters and Balancers," by W. A. Ker; "The Effect of Metallic-Filament Lamps on Supply Undertakings," by G. Wilkinson and R. McCourt; "Address to the Students' Section," by J. H. Rider.

"Electricity in Mines." By Prof. W. M. Thornton. Coal Trade Pamphlets, No. 7, May 6th, 1910. London: The *Colliery Guardian*. Price 1d.

The Aero Manual, 1910. London: Temple Press, Ltd. Price 1s. 6d. net. It is not long since were viewed the first edition of this interesting work. In the second edition the whole of the matter has been carefully revised and brought up to date, and there are a number of new features. Chapters on the management of some of the well-known aeroplanes have been contributed by men who have had considerable experience in their control, and the constructional side has been extended, so that the information in connection with this interesting subject has been greatly enlarged.

"Electric Traction on City and Suburban Railways." By H. M. Hobart, M.Inst.C.E.. Reprint of lecture delivered on October 14th, 1909, at the School of Military Engineering, Chatham. London: *Tramway and Railway World*. Price 1s.

"Atti della Associazione Elettrotecnica Italiana." Vol. XIV. March-April, 1910. Milan: Rebeschini Di Turati.

"Fortschritte der Elektrotechnik." 1910. Berlin: Julius Springer. Price 10 marks.

"Report of Board on Comparative Trials of the Scout Cruisers, *Birmingham, Salem, Chester*." December 22nd, 1909. Washington: Government Printing Office.

Trade Announcements.—THE EDISON AND SWAN UNITED ELECTRIC LIGHT CO., LTD., announce that from June 22nd next, their Newcastle stores and offices will be removed to more convenient and commodious premises—Swan's Buildings, St. James' Street, Leazes Park Road, Newcastle-on-Tyne. The management of this branch will still be in the hands of Mr. H. Smith.

MESSRS. JULIUS SAX & Co., LTD., announce that Messrs. Watson and Whyte, 19, Waterloo Street, Glasgow, will in future represent them in Scotland.

Mr. H. Wittusen, who has for some years been manager of the electrical department of Messrs. Johnsen & Jorgensen, Ltd., has severed his connection with that firm, and will commence business on his own account under the style of HARRY WITTUSEN & Co., as from July 1st, 1910, at 27, Shoe Lane, London, E.C., where he will handle all classes of glassware for electrical purposes.

Bankruptcy Proceedings.—E. W. BARTON WRIGHT, electric therapeutic specialist, 1, Albemarle Street, Piccadilly, London.—In this case the receiving order has been rescinded and the petition dismissed, the judgment upon which the bankruptcy proceedings were based having been set aside by order of Mr. Justice Parker, on May 2nd, 1910.

WM. HENRY TREATHAM, consulting engineer, 39, Victoria Street, Westminster, S.W.—A receiving order was made on May 19th on a creditor's petition. First meeting, June 3rd; public examination June 28th, both at Carey Street, W.C.

Robert Edward Joy (trading as the Bristol Electrical Co.) electrical engineer, 143, Cheltenham Road, Bristol.—The public examination of the above debtor was fixed to be held last week at the Guildhall, Bristol, but Mr. Registrar Wright ordered the case to stand adjourned.

Electro-Soldine.—This is a non-corrosive soldering flux in the form of a paste, which, it is claimed, is as effective as the so-called "spirits," but does not injure even the most delicate work. We have received a sample tin of it from the Electro-Soldine Co., Padiham, Lancs.

LIGHTING and POWER NOTES.

Argentina.—The Compania Electricidad de la Provincia de Buenos Ayres has just purchased for one million dollars the electric plant which supplies current to Mar del Plata. When the agreement is definitely signed on July 1st, the new company will immediately proceed to carry out several necessary improvements in the service, and to facilitate the work a local directorate will be appointed.—*Review of the River Plate.*

Barking.—The electrical engineer has prepared a report upon three alternative schemes for the extension of the present generating station, or the removal of same to a new site. The matter is to be considered shortly, and in the meantime the report has been circulated amongst the members of the Council. The engineer has been instructed to report upon laying an underground cable through the Faircross Estate to Upney, suitable to meet the requirements of the estate and the hospital.

Canada.—The Winnipig Council, in spite of its own large power development, is about to accept an offer by the Reese Engineering Co. of a minimum of 2,500 H.P. at $20 per H.P. from a local hydro-electric plant. Within a radius of 8 miles of Ottawa some 200,000 water H.P. is available, and within 55 miles radius it is estimated that 917,000 H.P. can be similarly obtained; electric power is now available at $10 per H.P. In Montreal, since 1908, the residential supply rates have been reduced by 30 per cent., and the commercial supply rates by 25 per cent. The Montreal Light, Heat and Power Co. is expending $750,000 in extending its gas and electric departments during the present season.

Continental Note.—Germany.—Some 30 of the principal townships in the Erzgebirge are to be supplied with electric light and power from a central station to be built at Schwarzenberg. The concession has been secured by the Deutscher Elecktricitätswerke, a company which had previously acquired the Schönheide communal station.

Devonport.—At a meeting of the Electricity Committee held last week, the chairman made an interesting statement, from which it appeared that the gross profit for the past 12 months amounted to £7,468, and the net profit was placed at £1,011 after paying all interest and sinking fund charges. The cars on the extension lines were stopped for nine months and two weeks of the financial year, which meant a drop in the sale of current equal to some 122,717 units, representing a sum of £716. In spite of this, by extended business in other directions, the income had reached within £218 of that of the last year preceding. A saving of £627 had been effected in the coal bill as a result of the use of mechanical stokers. The increase included sale of current to the D. & D Tramway Co., £5,384; Plymouth, Stonehouse and Devonport Tramway Co., £2 353; private consumers in Devonport, £4,154; in Stonehouse, £3,889. The total increase amounted to £17,819. The Committee decided to place the £1,011 to the reserve and renewals fund, which now stands at £2,289. The Committee passed the accounts, and decided to recommend to the Council a reduction in the price of energy for lighting purposes of ¼d. per unit. This, if agreed upon, will reduce the price per unit for lighting from 4d. to 3¾d. The ¼d. reduction represents a sum of £450.

Edinburgh.—A number of householders on the Barnton Park estate have made application to the Corporation for electric light. The Corporation has now power to go outside its own area into another area with the consent of the local authority concerned. The Electric Lighting Committee has had an extension of the mains under consideration, and it is stated that a considerable number of prospective users of the light for a period of three years have already been intimated. The matter will be further discussed.

Exeter.—The year's working of the electricity undertaking, ending on March 31st, showed a gross profit of £10,023. The total income was £18,235, against £8,211 expenses. After deducting interest, sinking fund, income-tax charges, &c., the net balance for the year is £2,736, the largest yet shown in the history of the undertaking. During the year a hundred additional consumers have been connected up, but the output and revenue for general lighting remained practically stationary, due to the extensive adoption of metal-filament lamps.

Fleetwood.—Owing to numerous applications for electricity for lighting and power, the U.D.C. will shortly consider the question of extending the plant and buildings at the electricity works.

Glasgow.—A Special Sub-Committee of the T.C. has for some time been considering the advisability of approaching Government for a change in the law relating to the taxation of pipes and underground works of the Corporation departments, including those of the tramways and electricity sections. The underground works and pipes within the city area are assessed at one-fourth their annual value, whereas outside that area they are rated at the full annual value. In a report on the subject now issued, it is pointed out that were the latter course adopted within the city area the departments concerned would have to pay an extra £35,000 annually, equal to a reduction of the municipal rates of about 2d. in the £. In a memorandum drawn up by the town clerk, it is stated that the tramways department in this case would have to contribute £19,878, though the traffic has shown a considerable falling off, while the electricity department's contribution would be £7,453, though the surplus for the past three years had been £3,808, £3,069 and £910 respectively, and it was clear that the department would either have to increase the cost of electricity or reduce the amount written off for depreciation in plant. The Committee-in-Charge has now recommended the T.C. that it is not desirable to approach Parliament for the assessment on their full annual value of the underground pipes and other works, and a Special Committee has been appointed to take joint action with corporations and others interested, on the lines of that decision.

Grays.—The U.D.C. has decided to replace 44 Nernst street lamps with 200-C.P. metallic-filament lamps.

Lymington.—The T.C. has accepted the tender of the E.L. Co. for public lighting for five years at £273 12s. 6d. per annum. The Gas Co. tendered at £235 per annum for ten years.

Nottingham.—On Monday the Corporation decided to apply over £72,000 from the profits on the gas, electricity and tramways undertakings towards the relief of the rates. Despite this substantial help, however, owing to the increased demand, chiefly for educational purposes, it was found necessary to increase the district rate.

Rawtenstall.—The T.C. has arranged for electricity to be supplied to the quarries of Messrs. Thos. Windle & Son, Waterfoot, the works of Messrs. Hoyle & Bolton, Cowpe Road, Waterfoot, and the Borough Mineral Water Works, Waterfoot.

South Africa.—Cape Colony.—The construction of the Oudtshoorn power station for the electric lighting installation of the town has been taken in hand.

Natal.—Following the example of the Cape Government, in arranging with the Corporation for the supply of electric power to the Salt River Railway works, an arrangement has now been entered into between the Maritzburg Corporation and the Natal Government for a supply from June 1st of electric current for all railway requirements in the capital. A similar arrangement is under consideration by the Durban Municipality for the supply of current to the large workshops at the port.

A scheme has been drawn up by the borough electrical engineer for the supply of current to all the Government departments in Durban, which is to be approved by the Government.

Swaythling.—The P.C. has entered into an agreement with Southampton T.C. for public lighting by electricity.

TRAMWAY and RAILWAY NOTES.

Argentina.—The plans presented by the National Tramway Co. in La Plata for the exchange from horse to electric traction have been approved.

Australia.—Interesting particulars relative to the electric tramways of the Commonwealth have been published by the Commonwealth Statistician. These statistics concern the year 1908-9, and, of course, the electric tramways that have been running in South Australia only since March 9th, 1909, have not been taken into account. The route mileage open for traffic and the number of passengers carried in the year in question were as follow:—

	Mileage.	Passengers.
New South Wales	105 ...	173,733,000
Victoria...	34½ ...	7,497,000
Queensland	30⅜ ...	29,732,000
Western Australia	47½ ...	13,136,000
Tasmania	9 ...	2,677,000

The capital cost, gross revenue, and working expenses were as follow:—

	Capital cost.	Gross revenue.	Working expenses.
N.S. Wales ...	£3,756,211	£1,011,819	£788,010
Victoria	290,815	66,148	50,820
Queensland ...	*	192,271	*
W. Australia ...	968,567	142,182	91,770
Tasmania ...	88,500	26,789	14,446
	£5,104,093	£1,439,209	£945,046

* Not available.

The number of employés is given as follow:—New South Wales, 5,523; Victoria, 312; Queensland, 614; West Australia, 354; Tasmania, 105. Total, 6,908.

Algiers.—Surveys are being made in connection with a scheme to supply potable water to Tunis, in the realisation of which it is intended to employ a number of electrically-driven machines. At Constantine the prefectoral officials are contemplating the erection of a hydro-electric station at the falls near the city to provide the energy to work a network of electric tramways, and to furnish electricity for lighting and power purposes. Renewed invitations are also made by the Conseil-Général for tenders for the building and working of an electric tramway from Oran to El-Ancor.

Belfast.—At the meeting of the Tramways and Electrical Committee on the 23rd inst., the city electrical engineer submitted a report as to the additional plant which would be required in his department in connection with the proposed tramway extensions, and for the purpose of his report, divided the lines into two sections. Section A comprised those lines which could be supplied direct from the generating station, namely, Donegall Road, Botanic Avenue and University Avenue, Stranmillis Road, Ligoniel, Castlereagh Road, Bloomfield and Old Lodge Road, and Oldpark Road. Section B included those lines which would be supplied by current transformed at the Fortwilliam sub-station, namely, the suggested M'Art's Fort tramway, and, in view of the purchase of the Cavehill and Whitewell line, the Glengormley extension. In regard to Section A, Mr. Bloxam stated: "The present tramway plant at the generating station consists of three 1,000-KW. steam dynamos, and, for emergency one of these should be held in reserve as a spare, leaving 2,000 KW. available for ordinary service. The present service requires 2,640 KW. on ordinary days, and 3,080 KW. during the winter months. The proposed extensions, Section A, with a 10-minute service, will require an addition of 169 KW. for ordinary working, bringing the total up to 3,249, or 1,249 KW. in excess of the plant available, allowing the spare mentioned above. The existing plant is installed in 1,000-KW. units; therefore it would be desirable to add a unit of this size. I estimate the cost of this addition as under: One 1,000-KW. steam generator, £7,890; condensing plant, £1,540; boilers, pipes and foundations, £3,740; switchgear, £300—£13,470." As to Section B, the report stated: "The present tramway plant at the Fortwilliam sub-station consists of two 125-KW. transformers, and, for emergency, one of these should be held in reserve as a spare, leaving 125 KW. available for ordinary service. If the Glengormley line is purchased and doubled, and a 10-minute service established, this will require 250-KW. of transformers and switchgear. I estimate the cost of this as—one 120-KW. transformer and switchgear, £1,389. If, in addition to the above, the M'Art's Fort line is built, the tramway plant in the sub-station will require to be capable of supplying 540 KW., if not more than five cars are ascending the hill at one time. This would be effected by transferring and adapting the duplicate transformers at present at the generating station to the sub-station, and replacing them by duplicate steam-driven alternators, each equivalent to, say, 600 KW. The existing duplicate E.H.T. feeders are designed for 500 KW., but could be overloaded 20 per cent. intermittently. I estimate the cost of the plant required as under:—Two 600-KW. alternators, £11,352; condensing plant, £2,217; boilers, pipes and foundations, £4,488; switchgear, £500; alterations to transformers, £200; total, £18,757." In Section A the estimated expenditure under this head was £17,269, and in Section B £10,090—£7,408 of the latter total applying to the M'Art's Fort extension, and £2,682 to the Glengormley line. The requirements may be summarised as follows:—City lines: Machinery, £13,470; electrical equipment, £17,269; total, £30,739. M'Art's Fort and Glengormley—Machinery, £18,757; electrical equipment, £10,090; total, £28,847. Glengormley only—Machinery, £1,389; electrical equipment, £2,682; total, £4,071. After some discussion a sub-committee was appointed to go more fully into the question of the M'Art's Fort extension, and the further consideration of the extensions generally was deferred until the receipt of the sub-committee's report.

Bradford.—The net profit on the Corporation tramways for the last financial year amounted to £32,300, which is in excess by over £10,000 of any previous record. Decreased working expenses, and an increase of £15,000 in receipts, contribute to this result.

British Columbia.—The Western Canada Power Co., of Vancouver, B.C., will shortly commence the construction of an 8-mile electric railway, which will be operated in conjunction with its new power plant at Stave Falls, from whence the first power was delivered last week.

Canada.—According to Government statistics the total mileage of electric railways in Canada in 1909 was as follows:—

First main track	989 miles
Second „	215 „
Total „	1,204 „
Sidings and turn-outs	83½ „
Total: Single track	1,287½ „

The gross earnings of these lines during 1909 were $14,611,484, and an aggregate of 395,697,616 passengers was carried.

Continental Notes.—SWITZERLAND.—The Ofenberg Railway, the concession for which has been recommended to the Cantonal Councils by the Swiss Bundesrat, is one of the most important of electrical undertakings hitherto contemplated. The whole line will have a length of 52·680 km., of which 40·680 km. lie on Swiss soil and 12 000 km. in the Tyrol. The line rises from 1,500 m. above sea level at Zernes (its starting place) to 1,973 m. at the top of the Ofenberg, the steepest gradient being 40 per cent., and the smallest curve, 120 m. Throughout its course the line will negotiate the roughest mountain country, passing through hills by means of tunnels and spanning stream-valleys. It will be worked by single-phase current at 6,000 volts, supplied from a power station to be built on the Etsch River, near Mals. The estimate of the cost for the whole line from Zernez to Schluderns is put at 16,745,000 fr.

GERMANY.—A further step has now been taken in connection with the projected conversion to electric traction of the Dessau-Bitterfeld section of the main line between Magdeburg and Leipsic, which is proposed by the Prussian Government as an experiment for working fast traffic. The step relates to the placing of orders for the equipment of the power station now being built by the Government. The Siemens-Schuckert Works are to supply the generator, the A.E.G. the steam turbine and the Brown-Boveri Co. the transformers.

RUSSIA.—According to the *Financier*, one of the features of the International Exhibition of Electricity Applied to Railways, which is to be held in St. Petersburg from August 28th to November 28th, will be a 2-mile stretch of normal-gauge railway, to be utilised for the purpose of comparing the running of independent electric locomotives and motors, and also for demonstrating different systems of electrification. Although the time allowed for preparation since the first announcement was issued has been short, it is to be hoped that British firms will be adequately represented.

SWEDEN.—According to the *Daily News* correspondent, the Swedish Parliament has voted a sum of £1,204,000 for the establishment of an electric power station by the Porjus Falls, in the Lule River, in Lappland, in order to supply motive power to railway traffic between Kiruna and Riksgraensen (on the northern frontier), as the transport of coal through the region is too expensive. The electric power thus created will also be used for reducing iron ore into pig-iron.

The Porjus Falls are one of the prettiest tourist resorts of Northern Sweden, though somewhat inaccessible. They are situated some 70 miles from Kiruna.

AUSTRIA.—The *Electrical World* gives the following cost of operating Stoll trackless trolley cars in Austria. In Vienna each car covers a distance of about 75 miles daily, and the total cost for this distance is calculated at from 7 to 9 cents per mile. The items of the total are:—Energy at 1 cent per KW.-hour, from 40 to 60 cents; tires from $1.50 to $2; wages from $1.60 to $1.80; garage management, repairs and renewals, from $1.70 to $2.40. Three cars, each with 21 seats, carried 132,000 passengers in four months over a route 2·3 miles long. The system is also in actual operation at Gmünd, Lower Austria, and is now being installed at Pressburg, Hungary. The last line will be 3·6 miles long, and four overhead conductors, six passenger cars, and a freight wagon will be provided at a total cost of about $60,000.

Edinburgh.—The Electric Lighting Committee recommends that the rate to be charged the tramway company for energy at Slateford Road be 1½d. per unit for the first year. The construction of the tramway to the new markets at Gorgie is well advanced.

Egypt.—The new electric railway between Cairo and Heliopolis is now practically finished, and will shortly be opened for traffic. There are three intermediate stations on the line, and the trains, which will be well appointed, will make the journey in 10 minutes.

Exeter.—The tramway balance-sheet for the year ending March 31st shows a surplus of £464 after wiping out the deficiency of £131 inherited from the previous year. The miles run were 424,873, and 598,718 units of electricity were used, costing £4,366, or 2·466d. per car-mile. The sum of £464 was placed to reserve and renewals.

Glasgow.—The Tramway Committee has this week been experimenting with a new type of car designed principally with the object of protecting the motorman in inclement weather. The matter is one which has exercised the Corporation for years, the primary difficulty of screening the driving platform being the back draught down the front stairway when the car was in motion. It is believed that this has been obviated by a simple expedient—permanently covering about two-thirds of the stairway and enclosing the upper platform with a sliding door on the roll-top desk principle. The decision of the T.C. to allocate a portion of the tramway surplus towards the reduction of the city taxes has drawn forth protests from various public bodies. These have been allowed to lie over meantime.

The T.C. is to be asked at its first meeting to consider a proposal asking that a coupon system be adopted so far as to give two of the present ½d. stages for ½d.

Hadleigh.—The P.C. has written to the Southend T.C. asking that the tramways may be extended to the parish. The matter is being considered by the Light Railways and Electric Light Committee.

Heywood.—At the T.C. on Thursday a profit for the past year was reported on the electricity department, while there was a loss on the tramways department of £1,187. There had been 109,376 fewer passengers carried than in the previous year and this was accounted for by the bad state of trade.

Japan.—Work is well in hand on the construction of the Karasumori-Yurakucho electric tramway in Tokio, and it is expected that the line will be opened for traffic at the end of July next.

A company has just been formed in Tokio with a capital of 3½ million yen to build an electric railway between Hiro-o, a suburb of Tokio, and Hiranuma. It is proposed to lay down four tracks, two of which will be used for a service of express passenger trains, and two for goods traffic.

It is announced that the Yokohama Electric Tramway Co. has applied to the Japanese Government for permission to construct an electric railway between Yokohama, Kanagawa and Dzushi.

South Shields.—The report of Mr. L. E. Harvey, general manager of the Corporation Tramways, on the past 12 months' operation of the system shows a net balance, after meeting working, interest and sinking fund charges, of £1,650, which was transferred to reserve. This is an increase of £1,227 over the previous year's net balance. In view of the differences between the electricity and tramways departments as to the metering of the energy to the tramways, it is of some interest to refer to this matter. For the year ending 1909 the tramway power cost, mutually agreed on between the Committees, amounted to £7,106, or 1·52 units per car-mile; the tramway manager, however, estimated that not more than 1·4 units per car-mile were used. The power cost for the last year amounted to £6,189, showing a reduction of £918 on the previous 12 months; a portion of this reduction was due to the use of meters on the cars for three months. For the first nine months of last year, before meters were installed on the cars, 1·36 units per car-mile were used, thus verifying the tramway manager's estimate. Since installing meters, the February average units per car-mile amounted to 1·196, and the March average to only 1·188, and it is estimated that over a complete year, as a result of installing meters on the cars, the consumption should, in future, average 1·2 units per car-mile. Assuming that this figure is realised, a further reduction of £500 should occur in power cost during the present year. Mr. Harvey emphasises the value of car meters in this connection, and points out that he has also been able to approximate the loss in the feeder system, finding that about 10 per cent. of the current registered against the tramways at the power station is lost in distributing it, which is equivalent to a monetary loss of £600.

Torquay.—An intimation has been received that the Board of Trade will not renew the licence for the present surface-contact system of tramways unless considerable improvements are effected, especially in respect of the working of the studs, after October 30th next, when the present term expires. This may lead to a conversion to the less expensive overhead system, with probably a more frequent service of cars, which, it is understood, would not involve a decreased supply from the Corporation electricity works.

At a special meeting of the T.C. on Monday, Councillor Pike (chairman of the Tramways Committee) made a lengthy statement on the position in connection with the tramway service. He stated that the B. of T. had intimated to the company that, owing to defects and deficiencies, it could not see its way clear to issue a further licence after the present one expires, next October. The Act empowering the tramways in the borough provided that the system must be the Dolter surface-contact system, but, in case of failure, the system to be used should be subject to arrangement. However, the Act also provided that on the Torbay Road the overhead system should not be used, except with the Council's consent. They had tried the Dolter system, and he would not say it was a failure. It was not a success; at all events, it was a failure in the eyes of the B. of T., and a failure in the view of the Tramway Co. The whole thing had been a gigantic experiment, but it was safe to say that had they not introduced the Dolter system they would have had no tramway at all. In his opinion, the only step they could take was to allow the company to provide an overhead system. Unless the Council agreed to the overhead equipment, there were two positions open to the Tramway Co.—to give up the concern altogether or to resort to arbitration. He proposed that the matter be referred back to the Tramway Committee for further consideration, and to leave them to arrange with the company and report to the Council, and this was agreed to.

Tottenham.—The Council is to communicate with the B. of T. or the Light Railways Commissioners, and ask them to bring pressure to bear upon the Metropolitan Electrical Tramways, Ltd., to proceed with, and complete the construction of the light railway between Tottenham and Walthamstow as soon as possible.

Tyneside.—An interesting experiment is being made by the tramway authorities on the north side of the Tyne. There is a continuous line of tramway from Scotswood, through the city of Newcastle-on-Tyne, Wallsend, Willington Quay, North Shields, to Tynemouth, a distance of about 11 miles. The management of the Newcastle Corporation tramways, in conjunction with the Tyneside Tramways and Tramroads Co. and the Tynemouth and District Electric Traction Co., has arranged a system of through fares from a central position in Newcastle to Tynemouth Palace on the seashore, the return fare being 9d. (and the distance about 9 miles), as against 1s. by the North-Eastern Railway, which has a very frequent service of electric trains. Whether the scheme will be profitable remains to be seen, but no fewer than 3,190 persons availed themselves of the run on Whit-Monday.

Uruguay.—The "Diario Oficial" of April 14th contains particulars of a Bill laid before Parliament on April 12th relative to a contract with Mr. Edwin Steer for the construction and working of an electric railway, to be called the "Ferrocarril Expreso Eléctrico Monte Video-Buenos Ayres. The line will run from Monte Video *via* Libertad, Santa Ecilda, La Paz and Rosario to Colonia, whence there will be a steamship service to Buenos Ayres. The concession includes powers for the carrying out of irrigation and water works, and also for hydro-electric works. The concession is for a term of 90 years.—*Board of Trade Journal.*

Walthamstow.—According to a recent report by Mr. Wm. Murray, the tramway manager, the local tramways undertaking gives promise of a satisfactory future, whatever may have been its shortcomings in the past. During its five years' existence, the route-mileage and number of cars have remained stationary, but the traffic revenue has mounted steadily, year by year, from £20,697 to £34,088 during the year ending March 31st, 1910. During the same period the passengers carried have increased steadily from 5,743,010, in 1906, to 10,641,127, in 1910, the receipts per car-mile being 7·60d. and 9·30d. respectively. The manager points out that it requires, roughly, 8·5d. per car-mile to clear expenses. The outstanding feature of the past year's working was the inauguration of through-running with West Ham and Leyton, which, since March 1st last, has developed into an every-day service of cars between Chingford Mount and Stratford Broadway.

Watford.—The U.D.C. has decided that, in view of the fact that the Corporations of Bradford and Leeds have obtained Parliamentary powers to enable them to construct railless traction systems, it is desirable that the construction of the proposed light railways in Watford be deferred for a few months. In regard to the supply of electricity to Munden and Hansteads, further negotiations are proceeding with the North Metropolitan Electric Light and Power Co.

TELEGRAPH and TELEPHONE NOTES.

Anglo-French Telephone Cable.—It is reported in the daily Press that Glasgow is able to speak with Paris by means of the new cable with loading coils which has just been laid.

Wireless Telegraphy.—With a view to establishing wireless telegraphic communication between European Russia and the Far East, a station is to be established at Petropavlovsk, Kamschatka.

According to the *Australian Mining Standard*, the wireless stations at Sydney and Fremantle are to be equipped on the Telefunken system by Australian Wireless, Ltd., which has arranged to purchase all the patent rights of the Telefunken Co. for Australia and New Zealand.

Cuba.—A new telephone system on the Island of Cuba was inaugurated on Saturday last. It is stated to be the most up-to-date installation in the world, the exchange being automatically worked.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—BRISBANE.—June 22nd. Deputy Postmaster-General. Copper wire, insulators, battery material, &c. Local representation. Deposits may be paid at the High Commissioner's Office, 72, Victoria Street, S.W.

July 6th.—Cordless switchboards for the P.M.G.'s Department in South Australia. See "Official Notices" May 20th.

VICTORIA.—July 19th. 4,200 Commonwealth telephone sets, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

MELBOURNE.—June 8th and 17th. (*a*) 1,470 opalescent arc lamp globes; and (*b*) arc lamp carbons, for the City Council. See "Official Notices" to-day.

Barnes.—June 14th. Low-tension triple-concentric cable for the U.D.C. See "Official Notices" May 20th.

Batley.—June 2nd. One lighting and traction switchboard for the Electricity Works. See "Official Notices" May 13th.

Cape Town.—Tenders have recently been invited for one passenger elevator, one goods elevator, and four dinner lifts at the new Houses of Parliament. The Public Works Department, Cape Town, has the matter in hand.

Tenders are required for one passenger and one goods elevator for the new Law Courts, Cape Town. Particulars from Messrs. Hawke & McKinlay, architects, Cape Town.

Copenhagen.—June 2nd. Two 1,000-KW. converters or motor-generators for the Corporation. See "Official Notices" May 13th.

Cork.—Steam boiler with superheater, and electrically-driven feed pump, for the Cork Electric Tramways and Lighting Co., Ltd. See "Official Notices" May 13th.

Coventry.—May 30th. One 2,500-kw. turbo-alternator and condensing plant, four water-tube boilers, two fuel economisers for the Electricity Committee. See "Official Notices" May 13th.

Italy.—June 6th. Tenders will be received at the Royal Arsenals, Spezia and Naples, for the supply to the Italian naval authorities of electric lamps and lamp-stands, in two separate lots. See particulars given in this section in our last issue.

The municipal authorities of Rome are about to invite tenders for the supply of 30 kilometres of copper cable for overhead conductors in connection with the electric tramways.

June 5th.—Italian State Railways Administration. Seven electric motor pumps. Tenders to the Direzione Generale delle Ferrovie dello Stato, 16, Via Ludovisi, Rome. Only firms on the special list kept by the Italian State Railways Administration are generally allowed to tender.

London.—Hammersmith.—June 1st. High-tension sub-station switchgear, for the B.C. Electricity Department. See "Official Notices" to-day.

Newport (I. of W.).—May 30th. Providing and laying cables, and wiring for 100 points, at the new Isle of Wight Joint Hospital at Fairlee; H. E. Stratton, Clerk, 31, Pyle Street, Newport, I. of W.

Two 400-kw. motor-generators, one 600-kw. ditto, one booster, for the Electricity Committee. See "Official Notices" May 13th.

South Shields.—June 13th. Stores for the Corporation Tramways Department. See "Official Notices" to-day.

Tasmania.—Launceston.—June 13th: Overhead electric equipment of tramways for municipal authorities. June 27th: Synchronous motor-generators and battery, reversible booster, &c. Tenders in both cases to Mayor and Aldermen, Town Hall. Conditions, &c, from Town Clerk (one guinea deposit each specification).

Turkey.—June 15th. The Turkish Ministry of Public Works in Constantinople is inviting tenders for the concession for the construction and working of a further section of electric tramways in the town of Salonika.

Uruguay.—July 4th. Twenty electric cranes, 1·5 to 5 tons, for the port of Monte Video. Particulars from the Administrative Council of the Port.

Wallasey.—May 30th. Alternating-current transformers, for the U.D.C. Electricity Department. See "Official Notices" May 6th.

West Ham.—June 20th. Electric light installation at three schools, for the Education Committee. See "Official Notices" to-day.

CLOSED.

Bristol.—The Electrical Committee has entered into the following contracts:—Messrs. Sykes & Sugden, Ltd., for joint and junction boxes, 1910-1911 contract, £214; and with the Union Electric Co., Ltd., Ship Carbons, Ltd., and the Oliver Arc Lamp, Ltd., for the supply of the various kinds of arc lamp carbons required during the year ending April 30th, 1911, at schedule prices estimated to amount to £655.

Dewsbury.—The Corporation Electricity Department, Bradford Road, has placed an order (repeat) with Messrs. Ed. Bennis and Co., Ltd., for two "Bennis" stokers and self-cleaning compressed-air furnaces for a Lancashire boiler.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

Admiralty, Contract and Purchase Department.

Lampholders.—Edison & Swan, &c., Co., Ltd.; Evered & Co., Ltd.; The General Electric Co., Ltd.; W. McGeoch & Co., Ltd.

War Office.

Electric cranes.—Craven Bros., Ltd.
Electric motors, &c.—Lancashire Dynamo and Motor Co., Ltd.
Works services:—Extension of electricity supply, Aldershot.—Siemens Bros. & Co., Ltd.
" " Installation of electric light, Royal Army Medical College, Millbank.—Foote & Milne, Ltd.

India Office, Store Department.

Cables and electric light stores.—Siemens Bros. & Co., Ltd.

General Post Office.

Apparatus, telegraphic (Creed).—Creed & Co., Croydon.
Cable, paper core.—Johnson & Phillips, Ltd.; Western Electric Co.
Electric light fittings. General Electric Co., Ltd.
Telephones.—Peel-Conner Telephone Works, Ltd.
House telephones.—Gent & Co., Ltd.
Hard-drawn copper wire.—T. Bolton & Sons, Ltd.; British Insulated and Helsby Cables, Ltd.; Elliott's Metal Co., Ltd.; R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., Ltd.; J. Wilkes, Sons and Mapplebeck, Ltd.
Endless-band conveyor installation at King Edward Buildings, G.P.O.—A. Sauvée & Co., Ltd.; Spencer & Co., Ltd.

Long Eaton.—The U.D.C. Electricity Works has ordered (repeat order) two "Bennis" high-duty smokeless and gritless coking stokers and self-cleaning compressed-air furnaces from Messrs. Ed. Bennis & Co., Ltd.

Southend.—The T.C. has accepted the tender of the Railway and General Engineering Co., Ltd., for 100 renewable manganese plates for the repair of rail-joints, at £1 15s. each; and that of Messrs. Nalder Bros. & Thompson for 66 current limiters, at 15s. each.

Southwark.—The Electric Light Committee reports that it has had under consideration the question of the supply of carbons for the ensuing 12 months, the market price of which has considerably increased during the past few months. The Committee has, however, received the option of continuing the arrangement entered into in March, 1909, with the Union Electric Co. and the Sloan Electric Co, Ltd., for the supply of carbons at the then existing price—viz., £2 18s. per 100 pairs, less special discount—and has accepted same.

FORTHCOMING EVENTS.

Association of Engineers-in-Charge.—Saturday, May 28th. At 8.45 p.m. Visit to the printing establishment of Messrs. Edward Lloyd, Ltd., Salisbury Square, E.C.

Railway Signal and Telegraph Engineering Institute.—Monday, May 30th. At 7.30 p.m. At the Marylebone Church Institute Central Hall. Paper on "Automatic Switches, Relays and Signals," by Mr. F. W. R. May.

Faraday Society.—Tuesday, May 31st. At 8 p.m. At the Chemical Society. Paper on "Some Practical Experience of the Sherardising Process," by Mr. J. W. Hinchley, and other papers. Demonstration and exhibition of (1) Apparatus for the rapid determination of the resistance of liquids; (2) Apparatus for the determination of specific resistance of oil, by Messrs. C. V. Biggs and W. Pollard Digby.

Royal Institution.—Wednesday, June 1st. At 3 p.m. Lecture on "The Constitution and Internal Structure of Alloys," by Mr. W. Rosenhain (Lecture II).
Saturday, June 4th. At 3 p.m. Lecture on "Electric Heating and Pyrometry," by Prof. J. A. Fleming (Lecture I).

Rontgen Society.—Thursday, June 2nd. At 8.15 p.m. At 20, Hanover Square, W. Papers on "Practical Observations on Every-day X-ray and Electrical Work," by Dr. H. Pirie; and "Recent Improvements in Radiographic Technique," by Dr. R. Knox. Also demonstration of a new form of apparatus for producing rythmical variations in the strength of electric currents, by Dr. Hampson.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are announced:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, May 30th.—"A" Company. Recruits' infantry drill, 6 to 6.45 p.m.; company drill, 7 to 9.30 p.m.

Tuesday, May 31st.—"B" Company. Company drill, 7 to 9.30 p.m.

Wednesday, June 1st.—Gymnasium, 6 to 9.30 p.m.

Thursday, June 2nd.—"C" Company. Recruits' infantry drill, 6 to 6.45 p.m.; company drill, 7 to 8.30 p.m.; technical drill, 8.45 to 9.45 p.m.

Friday, June 3rd.—"D" Company. Recruits' infantry drill, 6 to 6.45 p.m.; company drill, 7.15 to 8.30 p.m.; technical drill, 8.45 to 9.45 p.m.

Saturday, June 4th.—Drill Cup Competition. Drill parade at headquarters, 3.30 p.m. Dress: Service dress with putties; arms will be issued at 3.30 p.m. Equipment to be worn: Belt, frog, haversack and water bottle.

(Signed) P. H. Campbell, Capt. R.E., Adjutant.
For O.C. E.E., L.D.

The Trade of Peru.—The British Consul at Lima, in a recent report, states that the remote Amazon regions under Peruvian rule are in communication with the capital by means of the wireless stations established in recent years by the Government on the German system at Puerto Bermudez, Masisea, Iquitos, Requena and Orellana. The sum of £7,000 has been voted by Congress for the establishment of wireless connections through the Montana, or forest regions, on the eastern slopes of the Andes. The Peruvian Telephone Co. at Lima and Callao has spent £50,000 during the last two years in changing its system in the city of Lima from overhead to underground. Local batteries have been done away with, and a full central battery system has been established. The average rate of subscription per head is £7 10s. per annum, and the number of Lima subscribers is 1,600. The company also owns and works the overhead magneto exchange system still in use at the neighbouring port of Callao, but contemplates the rebuilding of the system within the next few months. The number of Callao subscribers is 260. It intends no change in the overhead system it owns and works in the surrounding small towns where the subscribers are as follows: Chorillos, 150; Miraflores, 50; and Barranco, 151. Telephone systems also exist at Arequipa, Chincha Alta, Pesco, Ica, Trujello, Piura and Paita. The total telephonic system connecting the various sections of the country may be taken at 3,000 miles.

THE ELECTRICAL OUTLOOK IN HOLLAND.

The British Consul at Amsterdam reports that the cost of the engineering works likely to be undertaken in the Netherlands and Dutch East Indies during the next few years is approximately as follows:—

Netherlands—	
Electrification of light railways and extension of steam tramways	£2,000,000
Erection of about 10 electric power stations ...	500,000
Gas and water works	1,250,000
Total	£3,750,000
Colonies—	
Electric light and power in 12 towns in Java, electric water power stations in four towns in Java, electric high-tension transmission in three provinces in Java and two electric motor-'bus services in Soerabaia and Semarang (Java)	£5,000,000
Electrification of the Java State railways	13,000,000
Railways and harbour works in Sumatra	15,000,000
Total for the Netherlands and colonies ... ... about	£40,000,000

There is a vogue in the Netherlands at present for electric tramways, and electric light and power, and it is anticipated that there will be an active demand for electric plant during the next two years. The same may be said with regard to the Dutch East Indies, where 20 important concessions were granted last year, besides which it is rumoured that the Java State Railways will be electrified. A steam tramway is to be built shortly to connect various villages in the Haarlemmermeer district, the length of the line to be about 60 miles, and the estimated cost £600,000. The name of the company, viz., Hollandsche Electrische Spoorweg Maatschappij indicates that electricity may be substituted for steam at a later date.

The Noord Zuid Hollandsche Tramway Maatschappij increased their capital last year by £270,000, in order to improve and electrify their lines between Haarlem and Leiden. An electric power station will eventually be erected in a central position in the network of lines between Leiden and Alkmaar. For the present, however, the power stations of Leiden and Haarlem will be utilised. The estimated cost of electrification is estimated by the company to amount to £6,666 per kilom. As this is twice the usual cost it is evident that none but the best material will be required. The light railway system in the province of Groningen is to be considerably extended in the near future, and a part, if not the whole, is to be electric. Most of the local industrial people and farmers would prefer electric tramways because they could then have electric power for their numerous dairies and manufactories. The concession for the horse tramways of the city of Arnhem recently expired and was prolonged for a few months in order to give time to the municipality to consider projects for electrification, and extensions to the suburbs at Oosterbeek, Velp, De Steep and Rheden. The concession for the construction of an electric tramway between Amsterdam and Wyk-aan-Zee, which had been granted to the North Holland Electric Tramway Co., has been withdrawn. Another concession will no doubt be applied for shortly. Taree benzine-electric motor carriages of the Westinghouse system have been ordered for the Ooster Stoomtram, a tramway service between Zeist and Arnhem. The mechanical and electric equipment will be supplied by the Westinghouse Co. at Havre, and the underframes will be built by the Nederlandsche Fabriek van Werktuigen en Spoorwegmaterieel at Amsterdam.

The British Consul at Jmuiden reports that a wireless telegraph receiver has been erected there, and is said to have picked up messages from Dutch vessels in the Mediterranean. The only public wireless telegraph station on the coast is at Scheveningen. All wireless messages from ships at sea or from lighthouses on the Dutch coast have to come *via* Scheveningen, whence they are forwarded to their destination by landlines.

The British Consul at Rotterdam reports that a company styled the Peel Central has been formed with headquarters at the Hague with a view to provide the provinces of North Brabant and Limburg with electric light and power and for the erection of the necessary plant in connection therewith. It is proposed to install the ordinary turbo-dynamos, and the fuel to be used in connection with the boilers will be turf to begin with and later gas refuse from a factory to be erected near the central station. It has been calculated that electric light can be supplied to the small villages which have no gas at a price 40 per cent lower than in the large towns of the Netherlands, so that these villages would benefit by the advantage of having electric light which would not exceed the price of petroleum. As regards the price of driving power, it is stated that the promoters of the scheme are prepared to quote such low rates that both the great and small industries would materially benefit in the long run. It has been estimated that 25,000 H.P. is at present applied for the purpose of the various industries of which it is proposed to make the electric power station the centre.

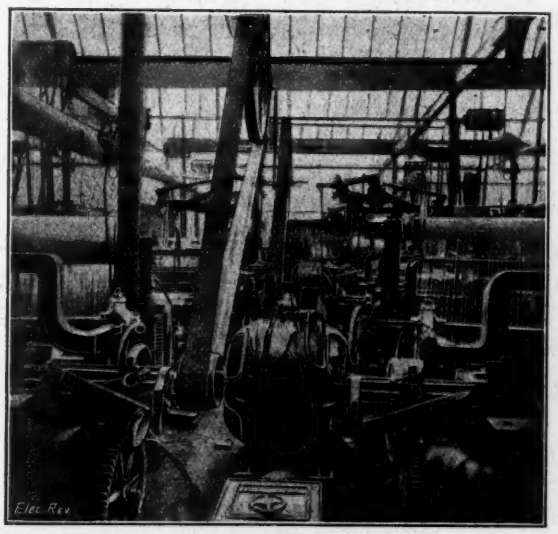
The Azores.—The British Consul in the Azores reports that the radio-telegraph stations at St. Michael's, St. Mary's, Faval, Flores and Corvo have now been completed, and are open for the service of the public.

NOTES.

Arc Works Athletic Club.—The race meeting this year is fixed for Saturday, June 18th, at Chelmsford. This fixture, which should not be missed by anyone interested in amateur sport, is, without doubt, one of the best in the country, for not only is the racing excellent and the track usually most tastefully decorated, but the meeting has the reputation of being one of the few in which the competitors run or ride all out. This year, owing, no doubt, to the success which attended the Essex County walking race on Whit Saturday, great interest is being taken in the walking event at this meeting, especially as several dark horses are reputed to be turning out for the event—in fact, so keen are some of the competitors, and so careful that their form shall not be known by the handicappers that they are not content with ordinary cycle pacing, but have tried a motor-'bus. A correspondent informs us that on Saturday last several of them hired a motor-'bus, and gave out that they were going to Southend for a day's outing, which they accordingly did; but on the return journey the 'bus stopped about 8.30 at Retendon, about 8 miles from Chelmsford, and as it was then getting dusk, they evidently thought a trial walk would excite very little interest, so they all got out, and keeping the 'bus just in front of them, no doubt as a pacing machine, started to walk to Chelmsford; but, to put people off the scent, they left the 'bus just outside the Chelmsford boundary. The first man reached Chelmsford at 1.30, so it can be seen that the walk was done in very good time. Some of the other competitors who did not take part in this trial walk are unkind enough to suggest that the 'bus broke down and that the walkers had to push it home, but we are of opinion that our version is the correct one, especially in view of the good time set up.

Lizard Submarine Bell.—The submarine bell which the Trinity Brethren decided to place off the Lizard was laid from the Trinity steamer, *Mermaid*, on Wednesday last week. This bell will operate in connection with submarine signalling to liners in times of fog. There is only one other bell of the kind around the shores of Great Britain, namely, off Holyhead. Unlike the experimental submarine bell near the Wolf Lighthouse, which works on a buoy through the action of the sea, the Lizard bell will be operated electrically from the lighthouse. The bell is suspended on a heavy tripod, about 3 tons in weight, which will be lowered to the bed of the ocean 1½ to 2 miles off the Lizard, and it will be connected with the lighthouse by cable. The bell was purchased from an American company, which has successfully laid similar ones down in different parts of the world. This bell will be of importance to the passenger shipping of the kingdom, as all the liners making for London and the English Channel ports fetch the Lizard.

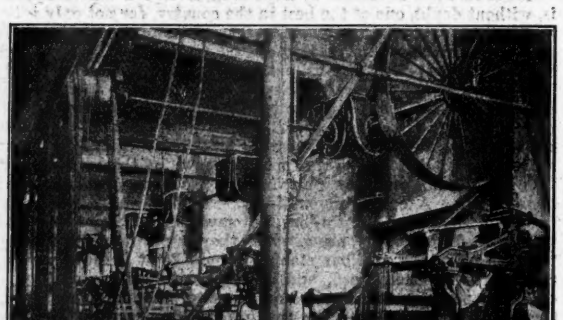
An Emergency Motor Drive at Blackburn.—It is always pleasant to record an enterprising piece of engineering work, such, for instance, as that carried out by the Blackburn Electricity Department recently in connection with a breakdown



Emergency Motor Drive.

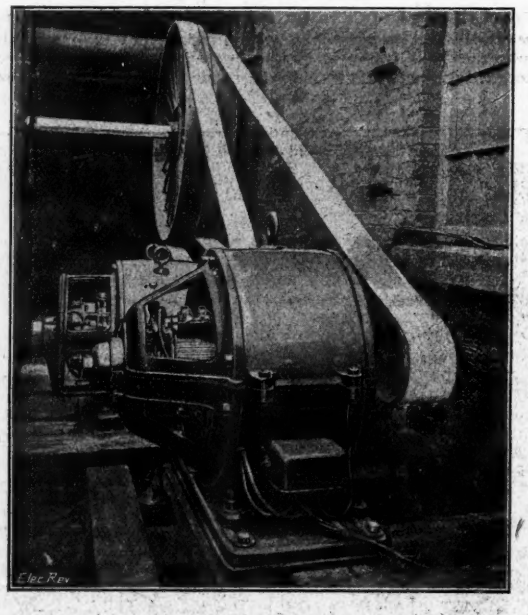
at a local mill. In this case, owing to a breakage of the gearing in the main drive, the 820 looms at the Struan Mill, Blackburn, came to a standstill; repairs were estimated to occupy three weeks, and as the firm were exceptionally busy at the time, a total stoppage would have been a serious matter. Under these circumstances the Electricity Department of the Corporation was called in, and under the guidance of Mr. Wheelwright, the borough electrical engineer, and his staff, temporary motors were installed in very quick time, thus enabling the output of the mill to be fully maintained. The Electricity Department received information of the matter at noon on Saturday, and by Monday morning 100 looms were being driven by one motor; on each of the two

succeeding mornings a further motor was started up, driving another 100 looms, while, on the next (or Thursday) morning, two additional motors were coupled up and another 250 looms started. The work presented considerable difficulty owing to its emergency character,



EMERGENCY MOTOR DRIVE FOR 100 LOOMS.

the motors used being just what were available at the moment; it was also necessary to provide a temporary switchboard, which was coupled up to the Corporation supply by means of cable carried over the roof of the building. In the case of the last 250 looms, restarted on the Thursday morning, two motors of different size and speed had, perforce, to be employed, driving on to one shaft;



TEMPORARY DOUBLE MOTOR DRIVE FOR 250 LOOMS.

the adjustment as to output between the two was arranged by using different sized pulleys and carefully speeding the motors as required. We congratulate Mr. Wheelwright on having demonstrated at least one of the several advantages of electric driving in such a convincing manner; we are indebted to him for our views.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS (BIRMINGHAM LOCAL SECTION).—The report of the Committee for the Session 1909-10 states that on October 21st, 1909, it was decided that the area of the Birmingham Local Section should be altered to include towns within a radius of 50 miles of Birmingham, excepting the Pottery towns and Nottingham. The membership has increased from 330 to 398. The Committee's nominees for office for the coming session have been elected *nem. con.* The list was published in our issue of May 6th.

ASSOCIATION OF ENGINEERS-IN-CHARGE.—The Social (Whist Drive) which had been arranged for last Saturday, was abandoned in consequence of the death of the King. To-morrow, at 8.45, the printing works of Messrs. Edward Lloyd, Ltd., are to be visited by members.

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION (DUBLIN CONGRESS).—This event, which had to be deferred owing to the King's death, will now take place at Dublin on Thursday and Friday, June 9th and 10th. The arrangements will be the same in every particular as those recently published for May 12th and 13th.

INSTITUTION OF ELECTRICAL ENGINEERS (LONDON).—The annual general meeting of the Institution was fixed for yesterday evening, when the report of the Council and statement of accounts for the year ending December 31st last was to be presented. The accounts disclose an income of £11,518, and a balance, carried to the general fund, of £3,283. The balance-sheet shows assets amounting to £84,907, including £57,124 expended in connection with the Institution building and lease. The building fund amounts to £39,189 and the general fund to £10,135.

The M.E.A. Meeting.—We have now received from the secretary, Mr. McArthur Butler, the full official programme of the Glasgow meeting, replacing the preliminary programme abstracted in our issue of April 8th. The only alteration in the papers is in the arrangements for Wednesday, June 15th. Mr. A. R Sillar's paper on "Chemistry of the Boiler House" does not now appear, and the only papers to be read on that day are:—

"Exhaust Steam Turbines and Condensing Plant," by Mr. F. A. Newington.

"Mixed Pressure Turbines," by Mr. Ashton Bremner.

The arrangements for the Thursday discussions are as follow:—

(*a*) "Advantages of Continuous Records of Costs and of Steam Consumption." To be opened by Mr. Geo. Wilkinson, Vice-President (chief electrical engineer, Harrogate), and Mr. C. E. C. Shawfield, Member of Council (chief electrical engineer, Wolverhampton).

(*b*) "Cheapening of the Cost of Mains and Services." To be opened by Mr. S. E. Fedden, Past President (chief electrical engineer, Sheffield), and Mr. S. J. Watson (chief electrical engineer, Bury).

Liverpool University Students and the Territorial Force.—The spirit of the civilian army movement has induced the engineering students of the Liverpool University to form a corps under the ægis of the Territorial Force, and it is hoped that Mr. Patterson Smith, of the Applied Electricity department, will secure a commission. The corps is to be named the University Detachment of the Lancashire (Fortress) Royal Engineers, detailed for searchlight duty on the Irish Coast Defence (Lough Swilly). So far 30 men have enrolled, and it is intended that the establishment shall consist of 50 rank and file, and one officer, and shall have charge of the searchlights in Lough Swilly. The entire corps will be composed of University engineering students. They go into camp next month.

Appointment Vacant.—Borough electrical engineer for the Salford Corporation (£500, rising to £700). See our advertisement pages in this issue.

Inquiry.—Makers of fine glass thread (1 mil diameter) are asked for.

Japan-British Exhibition.—In our preliminary reference to the electrical exhibits last week, we mentioned the "Robertson lamp" stand. We have since made another visit to the Exhibition and find that the words "Robertson lamps," which appeared round the dome of the stand as it was erecting, have disappeared. The General Electric Co., Ltd., have drawn our attention to the fact that their exhibit is essentially one for demonstrating the manifold good qualities of the "Osram" lamps. "Robertson's" are not on show. Perhaps we ought to explain that, as we wandered through the Machinery Hall a fortnight or so before the Exhibition opening, thirsting for information regarding what electrical firms were going to be in evidence, we came across a stand, the lower part of which was disclosed from the public view, and towering above all appeared the dome alluded to—presumably one that had done service at other Exhibitions—with the earlier wording still painted on. There has been quite a transformation since then, and if the word "Osram" is not stamped indelibly upon the mind of every visitor to the Hall, it will not be the fault of the General Electric Co. Journeying citywards on Wednesday, we noted some juvenile passengers in the tube displaying evident delight with the Osram novelty cards obtained at the stand. Early impressions are not easily removed!

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—The Finance Committee of Hampstead B.C. has concurred in a recommendation of the Electricity Committee that the salaries of the following officers be increased:—MR. GEORGE H. COTTAM, chief electrical engineer,

from £775 to £825 per annum; Mr. Egerton Sayer, chief assistant, from £365 to £390 per annum; and Mr. John Leadbeater, chief indoor assistant, from £325 to £360 per annum.

Mr. A. J. Abraham, electrical engineer to the County Council of Lanark, has resigned this position, as he has been appointed by Messrs. S. Sellon & Partners to the position of clerk of works to the electricity supply of Aberdare, S. Wales. Messrs. Stephen Sellon and Partners are the consulting engineers for the proposed Aberdare scheme.

Tramway Officials.—Bailie Russell (convener), Councillor Nelson, the general manager (Mr. Dalrymple), and the engineer (Mr. Ferguson) are to represent the Glasgow T.C. Tramways Department at Brussels in September.

General.—Councillor Dudley Stuart, M.I.E.E., has been appointed chairman of the Electric Lighting Committee of the Wimbledon Corporation, in place of Alderman A. Holland, J.P., who has resigned.

The Local Government Board for Scotland has appointed Mr. J. Walker Smith, at present burgh engineer and master of works, Edinburgh, to be engineering inspector to the board.

Mr. P. Sjollema has been appointed the chairman of the Beckenham Electricity Committee. The Beckenham Council has appointed Mr. G. Sutton, managing director to W. T. Henley's Telegraph Works, Ltd., to represent it at the Conference of the Incorporated Municipal Electrical Association, and has also authorised Mr. Tapper, the electrical engineer, to attend.

Mr. R. D. Page, who has for nine years represented the Isle of Wight Electric Light Co. at Ventnor, has secured an appointment with Messrs. Siemens Bros., Ltd.

At a meeting of the directors of the Metropolitan District Railway Co., held on 18th inst., a number of changes were made consequent upon Sir George Gibb's appointment as chairman of the Road Board. Sir George Gibb resigned his office as managing director, and Mr. Albert H. Stanley was elected a director and appointed managing director. Mr. J. Carter resigned his office as secretary, and was appointed as assistant to the managing director. Mr. W. E. Mandelick, the secretary of the Underground Electric Railways Co. of London, Ltd., and of the Allied Tube Railways, was appointed also to the secretaryship of the District Railway.

The *Australian Mining Standard* states that Mr. F. W. Clements, general manager of the Melbourne Electric Supply Co., Ltd., and chief engineer of the Adelaide Electric Supply Co., Ltd., left for London last month.

Obituary.—The death took place suddenly, from heart disease, on the morning of May 17th, of Mr. George Bremer, country representative for Mr. G. Braulik, of Lambeth Hill, E.C., in whose service he had been for over 20 years.

The death took place on May 17th of Mr. Geo. Ingoe, manager at Bury (Lancs.) for the National Telephone Co.

NEW COMPANIES REGISTERED.

Electro-Chlorination Syndicate, Ltd. (109,699).—This company was registered on May 18th, with a capital of £50,000 in 48,000 preferred ordinary shares of £1 each and 40,000 deferred ordinary shares of 1s. each, to acquire and lay down a working plant for the reduction of ores and the refinement of metals by new processes in chlorination and electrolysis, to carry on the business of miners, smelters, metal workers, &c., and to adopt an agreement with H. W. Couzens. The subscribers (with one preferred ordinary and one deferred ordinary share each) are:—A. E. Mavor, 39, Victoria Street, Westminster, S.W., engineer; H. W. Couzens, 39, Victoria Street, Westminster, S.W., engineer; C. Manuel, Caswell House, Isleworth, engineer; G. A. Zeden, 9, Queen Street Place, E.C., engineer; G. S. Burton, 4, London Wall Buildings, E.C., chartered secretary; F. W. Farley, 114, Grove Green Road, Leytonstone, secretary; P. Gussin, 203, Grange Road, Ilford, clerk. Minimum cash subscription £2,000; the number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; remuneration, £100 each per annum (chairman, £150). Registered office, 39, Victoria Street, Westminster, S.W.

CITY NOTES.

Callender's Cable and Construction Co., Ltd.

The fourteenth annual general meeting of the shareholders of this company was held on the 19th inst. at Hamilton House, Thames Embankment, Mr. Henry Drake presiding.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 794), said that the value of the business done by the company during 1909 showed a considerable reduction as compared with that of recent years, but seeing that 1909 was unfavourable to nearly every branch of the electrical and engineering industry, the directors were of opinion that the results shown could not be considered other than satisfactory. At no time for many years past had the conditions under which the company's operations were carried out been more difficult than in the period under review. The quantity of work available was even less than usual, and the struggle for orders was, consequently, severe. This was especially the case in the home trade, where no new contract of any magnitude was carried out, and where even the orders for extensions to existing mains were less in number and smaller in value than customary. Whilst this was doubtless due in part to the extended use of metal-filament lamps, it was greatly intensified by the universal depression which prevailed, and by the uncertainty in the financial outlook throughout the country generally. It was, therefore, with considerable satisfaction that the directors noticed the improvement in trade which had taken place since the beginning of this year, with the consequent increase in orders which had been placed with the company. Turning to the accounts, the bills payable were £67,965, as against £72,109, while trade creditors were £75,644, as compared with £50,838. The balance to profit and loss was £68,452, as against £72,134 a year ago. From that had to be deducted £8,750, the interim dividend paid last November, reducing the balance to £59,702, as compared with £63,384 last year. On the other side, the item of property was practically the same as in 1908. Stock in hand, raw materials, £91,163, compared with £80,035, and manufactured goods were £21,305, compared with £21,436 last year. The two items together amounted to £112,468, as against £110,473 a year ago. Expenditure on contracts in course of construction amounted to £77,329, as compared with £81,733, and cable drums stood at £18,635, as against £18,828. Sundry debtors were £136,171, as compared with £136,784, and the money retained by Corporations and others for fulfilment of contracts amounted to £29,193, as against £48,282. The profits for the year, after deducting all charges on manufacturing accounts and contracts, amounted to £98,135, which compared with £106,985 a year ago. Depreciation on property absorbed £8,294; interest on debenture stock £13,500, and the dividend on the preference shares £10,000, leaving a balance of £68,452 to be dealt with. Out of that it was proposed to pay a dividend on the ordinary shares at the rate of 10 per cent. per annum, which would absorb £17,500, and a bonus of 5s. per share, amounting to £8,750, leaving £42,202 to be carried forward.

Mr. C. H. McEuen seconded the motion.

Mr. T. O. Callender, managing director, in supporting the resolution, said that no one could be better pleased to see the back of 1909 than those who were responsible for the management of the company. It was a year full of trouble and disappointment—full of an immense amount of work which did not bring a proportionate return either in orders or in profit. On the whole the shareholders had to congratulate themselves on the results which had been obtained. When one looked at what had been done by others in the engineering line, in cable business, and in kindred enterprises, their company, in the profit they had been able to secure, stood out fairly well. Throughout the whole of this country and in a good deal of the rest of the world, including the Colonies and many foreign countries, the business upon which they mainly depended had been almost at a standstill. That had been brought about by various causes, and first among them was the use of the metallic-filament lamp, but although that had hit them very hard during the past few years, it was likely to prove a great advantage in the future. They had had full experience of the bad times which they led the shareholders to expect in that connection, and he was glad to say they were now beginning to find the advantage from the use of that lamp, and they were satisfied that it was going to be good to them as cable manufacturers which they anticipated. In addition to that, the absolute want of confidence throughout the country had hit them very hard. No person who had money to invest was prepared to sink it in lighting schemes, tramways or similar undertakings using electricity which had unfortunately been the prey of a good many people for several years past. The result was that no new enterprises were started, and the business they had had to do was simply in extensions of existing mains, which extensions were few and poor. In spite of all that they had done the best they could, and he thought the shareholders would agree that the results were satisfactory. The rise in the rubber market had also given them a good deal of trouble. It was quite evident for some time that trouble was going to arise in regard to rubber, but they did not anticipate anything like the rises which had taken place, and none of them had been fortunate enough to cover themselves at the low price of 2s. or 3s., which prevailed some years ago. In spite of the uncertainty in the rubber market, the demand for rubber wires had only been affected to a small extent. It appeared that a certain amount of trade must go on, and whilst there was less being used there could be no doubt that there was relatively a very large quantity of rubber still required for the purposes of the cable industry. With a rising market, where prices outstripped all calculations, it was always very hard for the manufacturer to cover the advance which he had to pay. That was the case with the Anchor Cable Co., but, in spite of that, that company had done exceedingly well, and had paid Callenders a dividend of 10 per cent. on their shares, and it had done even better for itself. He was glad to say that at the present time things were better than they were last year. They had already experienced a distinct improvement in the demand for cables both at home and abroad, and although they were not yet in the position of an overflowing order book, or of working right up to the hilt, they were in a considerably better position than they were this time last year. The board thought that, with a reasonable continuance of good business throughout the country, the result ought to be satisfactory for 1910. It was yet too soon to say anything as to the effect which might be caused on their trade by the death of the King. That undoubtedly would upset some of their calculations to a considerable extent, but how far it was impossible at the present moment to say. Therefore they must chasten their good views as to the future by referring to a possibility of slackening in the demand owing to the lamented death of his Majesty. As to their foreign business, their German company had been quite satisfactory. It was only a small business, but it was of the greatest

importance to them, and they intended this year to develop and extend it. After due consideration it had been thought advisable to extend further the scope of the company's business by pushing for purely engineering business. They had extended their foundry, and would probably still further extend it. They had been taking a lot of business in the South of England for ordinary foundry work, and they found that many of their friends with whom they had been in the habit of dealing with cables for many years past, were quite surprised to learn that they were also prepared to deal with heavy foundry castings. They found that this was a useful adjunct to their trade, and it had helped towards the satisfactory balance which had been brought into the accounts. They were also taking up one or two other side lines which they hoped would be profitable, and which would certainly be conducive to extending their connection. Their machinery, both at Erith and Leigh, had been kept up in first-class order, and their depreciation had been less owing to the fact that in 1909 they had done less work than in previous years.

The report was adopted.

Felten & Guilleaume-Lahmeyer Works.

The report for 1909 states that the year was a period of returning economic development which was of full advantage to the Carlswerk, whilst the undertakings in which the company was interested also yielded good results throughout and were almost all in course of favourable expansion. On the other hand, the dynamo works did not fulfil expectations, principally on account of the extraordinary decline in sale prices of machines and parts. Owing to the great pressure of keen competition, especially in the first half of the year, it was not possible to obtain sufficient orders to keep the dynamo works approximately full to the amount of their present capacity, so that the invoice value of the output of these works was 15 per cent. less than in 1908. The foreign subsidiary companies worked unfavourably in part, and as a consequence the dynamo works concluded the year with a loss. The total turnover was, however, about on the level obtaining in 1908, and the orders on hand at the close of the year represented a considerable increase over the end of 1908. The undernoted figures are given in the accounts for the two years:—

	1909.	1908.
Ordinary share capital	£2,750,000	£2,750,000
Bond capital	1,264,000	1,264,000
Gross profits	694,600	730,900
General expenses	292,200	268,400
Depreciation provision	114,000	115,200
Net profits and balance forward ..	208,100	278,100
Allocation to reserve fund	9,060	12,800
Dividend	165,000	220,000
,, per cent.	6	8
Carried forward	20,000	21,900

The report proceeds to state that increasing employment was obtained at the Carlswerk at Mulheim in the working up of iron and steel for the wire works, the wire nail and wire goods factories, and the galvanising works. The cable factory was well employed in the department for cables for heavy currents, but the limited demand on the part of the authorities influenced the branch for cables carrying weak currents. The copper works and the copper drawing mill were better occupied than in 1908, and most departments in the rubber factory were regularly employed; although the rise in rubber prices late in the year hampered sales. During the year the orders received at the dynamo works at Frankfort included 12,632 machines, of a total output of 480,000 H.P., whilst the deliveries were 11,220 machines, of 450,000 H.P., as compared with 10,200 and 520,000 H.P. respectively in 1908. The reduction in the average output of the machines ordered and supplied was attributed to the decline in large manufacturing installations, whereas the employment of small motors considerably increased. The factories for switchboard apparatus, meters, measuring instruments and metallic-filament lamps were still in course of development. In the case of electric main-line working the company's types had led to new and repeat orders, including a number of battery cars for the Prussian State Railways and a large locomotive for a French railway. The marine department had opened up further markets, and the new branches of manufacturing apparatus and equipment for the ozonisation of potable water and the air had afforded numerous orders for single apparatus and central ozonising installations. The number of officials and workpeople employed at the end of 1909 was 12,318, as contrasted with 11,357 at the close of the previous year. The report adds that all departments at the Carlswerk are at present well employed, whilst prices are better than in 1909. It is hoped that the unfavourable conditions at the dynamo works will soon be overcome, and the degree of activity in this case also has materially increased compared with last year.

Fife Tramway, Light and Power Co., Ltd.

At the first ordinary general meeting of this company, held on Monday, Mr. W. Low said it was due to the rapid construction of the tramways that the directors had been able to show a credit balance on revenue account after only six months' existence. The directors were satisfied with the position of the power company, and felt sure that it would this year make a substantial contribution to the revenue of the new company. They were satisfied with the volume of business secured, and he did not think he was unduly sanguine when he said the shareholders might look for a considerable and growing revenue from the power branch of the business in future. The tramway company had at present before Parliament, an application for power to construct tramways from Dunfermline to Rosyth Naval Base. At the same time authority was asked for other extensions. The Fife Electric Power Co. had made an arrangement with the Wemyss Co., whereby the latter was to take from the power company the whole of its supply of electricity, both for the existing Wemyss tramways, and for any extensions constructed under the extensions order at present before Parliament. Concluding, the chairman said the directors proposed to pay preference dividends half yearly, the first interim dividend being payable after the expiration of the half year, viz., June 30th next.

The report and accounts were adopted.

Cape Town Consolidated Tramways and Land Co., Ltd.—The directors report that, after charging London administration expenses and trustees' fees, and after crediting accrued interest and transfer fees, a balance of £941 is shown to the debit of profit and loss account for the year to December 31st, which, added to the balance brought forward of £1,228, makes the total to the debit of profit and loss account £2,169. Neither the estate companies nor the Camps Bay Tramway Co. have been able to declare any dividends during the past year. According to the *Financier* abstract, the Camps Bay tramways have worked at a loss of £1,559. This is a slightly improved result as compared with the operations of 1908, which showed a loss for that year of £2,232. There was a small increase in revenue amounting to £137, and the expenditure showed a decrease of £535. The Oranjezicht Estate, Ltd., has not been able to dispose of any of its building sites during the period under review. The land belonging to the Cape Marine Suburbs, Ltd., which is situated at Camps Bay, has also been unsaleable at any reasonable value during the past year. As there is at present no prospect that the company will be able to meet the charge for debenture interest due on January 1st, 1911, it is intended to apply to the debenture-holders for their consent to a further extension of five years for exemption from the payment of interest on debentures otherwise than out of profits, and to the raising of a loan for the general purposes of the company, on the security of a prior lien on all the assets of the company.

Potteries Electric Traction Co., Ltd.—The directors' report, as abstracted in the *Financier*, states that the total receipts for the year to December 31st amounted to £108,182. The traffic receipts, which amounted to £91,932, show a decrease of £399, due to the continued depression of trade in the district during the earlier months of the year. The working expenses, however, have been decreased by £5,136. After deducting all expenses chargeable to revenue, including £12,158 for debenture and other interest, there remains a balance of £26,169, making, with £1,121 brought forward, a total of £27,291, as compared with £21,781 for 1908. The directors recommend that the amount available for distribution should be applied as follows: Depreciation, reserve account, £2,000; general renewals account, £7,090; dividends at the rate of 5 per cent. per annum on the preference shares, £12,250; dividend at the rate of 2 per cent. per annum on the ordinary shares, £4,900; carrying forward to next account, £1,050. The depreciation and reserve account will then stand at £22,000, and there will be a credit balance on the general renewals account of £5,500.

Typewriting Telegraph Corporation, Ltd.—The directors' report for the period December 1st, 1908, to December 31st, 1909, shows that the balance to the debit of profit and loss account has been increased by £322 since the last report. The corporation has not been in a position to pay interest on the debentures since June 30th, 1907, and the directors regret that in consequence of the state of the corporation's financial position, they feel obliged to recommend shareholders to pass the extraordinary resolution for the purpose of liquidation. This is set out in the notice of meeting. The directors are unable to hold out any hope of improvement in the business, and the course they now advise should be taken appears to them to be in the best interests of all concerned. The meeting is to be held to-day, Friday.

Stock Exchange Notices.—Application has been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Metropolitan Electric Tramways.—Scrip for £250,000 5 per cent. debenture stock.

Vera Cruz Electric Light, Power and Traction.—Scrip, fully and partly paid, for £250,000 5 per cent. first mortgage debentures.

And to allow the following securities to be quoted in the Official List:—

Mexican Light and Power Co.—Further issue of $1,500,000 7 per cent. cumulative preference stock in shares of $100 each.

The Committee have appointed special settling days as under:—

June 10th.—New York Telephone Co.—Further issue of £2,500,000 4½ per cent. first and general mortgage 30-year bonds (London issue), Nos. C 15,001 to C 25,000 of £100, and E 5,001 to E 12,500 of £200 each; same are also to be officially quoted.

They have also ordered the undermentioned to be quoted:—

Para Electric Railways and Lighting Co.—70,000 ordinary shares of £5 each, fully-paid, Nos. 1 to 70,000: 14,000 6 per cent. cumulative preference shares of £5 each, fully-paid, Nos. 115,001 to 129,000; and £700,000 5 per cent. first debenture stock.

City of Birmingham Tramways Co., Ltd.

For the year ended December 31st, 1909, the directors report that £626 was expended on capital account. The sum realised during the year from the sale of tramways in Handsworth and other properties was £74,096, which has been credited to capital account.

The directors have had under consideration the expediency of calling up the balance of uncalled capital from the holders of the partly-paid ordinary shares, as the latter are of opinion that all the ordinary shares should participate equally in the division of the profits of the company. In view, however, of the large cash resources of the company, and of the fact that the company has considerable undivided profits in hand, the directors have decided to recommend the shareholders to equalise the amount paid on the whole of the ordinary shares by returning the sum of £4 per share upon each ordinary share upon which £5 has been paid. This payment will be made out of profits in accordance with Sec. 40 of the Companies' Clauses Consolidation Act, 1908, and will leave a liability of £4 per share on all the ordinary shares of the company.

The profit and loss account, after providing £12,000 for the year's interest on debentures, and £12,083 the dividend on the preference shares paid and accrued up to December 31st, shows a surplus of £38,517; deducting £2,105, being the interim dividend at the rate of 5 per cent. per annum paid on the ordinary shares for the half-year ended June 30th, 1909, there remains a disposable balance of £36,412. The directors recommend that the surplus be applied as follows:—Dividend on the ordinary shares, at the rate of 5 per cent. per annum for the six months ended December 31st last, together with a bonus of 5 per cent., making together 10 per cent. for the year, amounting to £6,314; the payment of £24,188, amounting to £4 per share in reduction of the paid-up capital of £5 per share upon 6,047 ordinary shares, Nos. 47,001 to 53,047 inclusive, subject to the passing of a special resolution to that effect; the transfer of £5,910 to reserve fund, to provide for depreciation of assets, redemption of debentures, and for general purposes. This fund will then stand at £517,779.

The tenth annual instalment of £10,000 payable under the trust deed has been duly paid to the trustees. The debenture redemption fund has further been increased during the year by £66,440, the proportion payable to the trustees of the purchase price of the Handsworth tramways, referred to below. The amount of the investments of the debenture redemption fund now exceeds the whole of the debentures issued, and the question is under consideration of the means to be taken for relieving the company of further payment to the trustees under the terms of the trust deed.

The traffic receipts, compared with the previous year, show an increase of £3,361, while the receipts from advertising and interest on investments show an improvement of £4,019. A reduction of £4,247 has been effected in the cost of maintenance of tramways and payments to local authorities.

It was stated in the last report that the Board of Trade had appointed an arbitrator to determine the price to be paid by the Handsworth Urban District Council for the company's cable undertaking in Handsworth and the disused line in Villa Road, Handsworth. The arbitration proceedings took place in June last, and the price payable by the Council was fixed at £72,174. This amount has been received from the Council. The Council are under obligation to grant a lease of the cable tramway to the company from the date of purchase to June 30th, 1911, and negotiations are taking place in regard to the terms of the lease, which, failing agreement, are to be referred for settlement to the Right Hon. Alfred Lyttleton, K.C.

Following on the award an agreement had been entered into with the Council for the operation of through services from Birmingham, through Aston, to the terminus of the Perry Barr route in Handsworth, and from Aston, through Handsworth, to West Bromwich, when the cable line is electrified, and the Villa Road line re-constructed and open for traffic. A Bill is being promoted in the present session by the Handsworth Council for the purpose, *inter alia*, of confirming the agreement.

Notice has been received from the Yardley Council of the intention of the Council not to exercise the option to purchase the electrical plant at the Yardley power station given to the Council by the agreement mentioned in the last report.

The company have protested against the charges made by the Birmingham Corporation for repairs to the permanent way of the Bristol Road tramway. The lease of the tramways from the Corporation provides that the decision of the city surveyor is to be final on all questions or differences that arise under the lease in regard to value, repair and construction. The company applied to the Corporation to appoint an independent person as arbitrator, but the Corporation refused to depart from the terms of the lease.

It was stated in the last report that a claim had been made against the Corporation for loss of traffic receipts arising out of the delay in completing the reconstruction of the Bristol Road tramway. The claim has been acknowledged by the Corporation, and a sum of £540 has been paid to the company.

The Birmingham and Midland Motor Omnibus Co., Ltd., has now disposed of all its motor vehicles, and its business is now confined to the operation of horse omnibus services in Birmingham, cabs, &c. A profit is shown as the result of last year's working.

The working of the company's undertaking by the Joint Committee continues to show satisfactory results, and the arrangement has been further continued.

	1908.	1909.
Miles open—Route miles	18·13	17·98
Single line	4·43	3·97
Double line	13·70	14·01
Passengers carried	35,171,451	35,700,198
Average receipts per passenger	·98d.	·99d.
Average working expenditure per passenger ..	·59d.	·59d.
Proportion of expenses to receipts	60 %	64 %
Cars in stock	152	149

Mr. Emile Garcke (chairman) presided at the Electrical Federation Offices, Kingsway, W.C., on the 19th inst., over the ordinary general meeting of the company.

In moving the adoption of the report, the Chairman said that for a company operating tramways in this country the position of the company might be described as unique. Notwithstanding that their lines were being gradually taken over by the local authorities, and that they were exposed to increasing competition from municipal tramways, their traffic receipts were increasing, and their net profits showed an improvement as compared with the preceding year. Their total receipts were £172,031, as against £164,607, and the net profit, after paying debenture interest and preference dividend, was £38,516, as compared with £36,977 in the preceding year. Turning to the balance-sheet the position was equally satisfactory. Their total liabilities over capital account and otherwise amounted to £625,479, made up of £300,000 debenture, £284,188 preference and ordinary share capital, £36,708 sundry creditors, and £4,583 accrued interest on debenture and preference shares to December 31st. Against that they had investments which stood in the books at cost and sundry loans and sundry debtors and cash in hand amounting to £697,098, and even if they deducted the cost of the shares in the Omnibus Co., which, in the auditor's view, was not a very good investment, they still had in liquid assets, apart from the remaining tramways and properties, more than the whole of their debenture share capital and liabilities to creditors. In addition to this, they had some remaining tramways and properties of considerable value, although not, of course, to the extent of the figure remaining in the balance-sheet. Nevertheless, the position of the company was quite satisfactory, and enabled them to look into the future with considerable confidence. There were various matters referred to in the report in regard to which he did not think it necessary to detain them. As to the disposal of the net profit of £38,000, they recommended the payment of a dividend of 5 per cent. on the ordinary shares and a bonus of 5 per cent., making a return of 10 per cent. for the year; that £24,181 should be applied in the reduction of the paid-up shares of £5 by paying back £4 on each share; and that the balance of £5,910 should be transferred to the reserve fund, to provide for depreciation of assets, redemption of debentures and general purposes. There would be a special meeting for the purpose of considering the proposition to return the capital on the ordinary shares, and then he would give the reasons why the directors brought forward that proposition. If the resolution was not carried at the special meeting, then the £24,181 would be carried forward.

Mr. G. C. Cunningham seconded the motion.

Mr. Icke wished to raise the question of the repayment of the capital, but

The Chairman gave an assurance that the opportunity would be given to discuss the matter at the special meeting.

Mr. Earouche said that as the shareholders were mainly in Birmingham, he thought the special meeting ought to be held there. He and other shareholders had come up from Birmingham at their own expense.

The Chairman said the shareholders were spread all over the country, and London was a more convenient place to come to than a provincial town. The secretary informed him that more shares were held in London than in Birmingham.

The report was then carried, and the formal resolutions for the payment of dividends, and the re-election of the retiring directors and auditors, were passed.

The meeting was then made special, and the Chairman moved "That out of the accumulated profits of the company the sum of £4 per share be paid to the holders of the 6,047 fully-paid ordinary shares of the company by way of reduction of capital, and free of income-tax, pursuant to Sec. 40 of the Companies' (Consolidation) Act, 1908." He said that the reason for bringing the matter forward now was because they were in a position of considerable financial strength. They had accumulated sufficient liquid assets to more than cover the whole of the debenture capital and the whole of their share capital. As a matter of fact, they had already paid over to the trustees of the debenture-holders a sum larger than the outstanding debentures, and they had investments and other readily convertible assets to an amount in excess of the preference shares, and there would be no difficulty in providing for the redemption of the whole of the capital. They could not, however, go into liquidation for various reasons. They had still many properties to realise, and the moment they went into liquidation the preference shareholders would cease to receive dividends, which would be a hardship to them. The holders of the partly-paid ordinary shares had for some years past made representations to the directors that it was unfair that they should carry a heavy liability of £4 a share on the 54,000 shares roughly, and receive no reward whatever in respect of it. They only received a dividend on the £1 paid up, whilst the fully paid-up shareholders were receiving a handsome return on the £5 shares paid up. It had been represented to the board that the fairness of the situation required that the two classes of ordinary shares should be put upon an equal footing, and they were quite willing that the liability of £4 on their shares should be called up. If that was done, however, it would mean that the company would call up something like £240,000, for which they could not find profitable employment; and, in addition, the present paid-up shares would suffer seriously, because they would not be able to continue to pay a dividend at the present rate on such an enormously increased capital. After serious consideration the board felt that they could not come forward with such a proposition as that. They were advised, however, that there was another legal way of bringing about the object in view, which was by repaying out of accumulated profits, the share capital, and they were proposing to repay the £4 per share on the fully paid-up shares entirely out of this year's profits, with the result that instead of enormously increasing the capital without any prospect of being able to pay a dividend on it, they would reduce the capital on which, without committing himself, he thought they would be able to maintain the present high rate of dividend, at any rate, until the properties were realised and they could reconsider the position. The course now proposed was not only the best legal course, but also the one which could be carried out with the least objection. If they tried to cancel the outstanding liability on the ordinary shares the debenture-holders would have the right to object, because the uncalled capital was additional security to them, and the same thing applied to the preference shareholders. Mr. Neale and others who did not approve of the proposal, might say the liability was only imaginary, but the fact that the debenture-holders and preference shareholders had the right to object to the cancellation of the liability, and would object, demonstrated the fact that they con-

sidered it worth having. Therefore, the only right way to deal with the matter was to put the two classes of ordinary shareholders on an equal footing. The sacrifice to the fully paid-up shareholders was that they would receive the £4 per share, instead of leaving it with the company, where it was earning 10 per cent., and have the liability.

Mr. G. C. Cunningham, in seconding the resolution, said they were rapidly approaching the end of the company, and the question of the division of the assets was a troublesome one to deal with. They must face the question of putting the different classes of shares upon the same footing so as to arrive at an equitable division of their assets, and the alternative to the proposal was the calling up of the £4 unpaid on the partly paid ordinary shares. He had made a calculation which, curiously enough, showed that whichever course they adopted they would arrive at practically the same profit to the shareholders. Assuming that their assets for division were £200,000, then if they called up the £4 unpaid capital, they would get £215,812, which would make the total assets to be divided £415,812, and these divided amongst 60,000 shares of £5 each, would give a return of £6 18s. 7d. per share, or a profit of £1 18s. 7d. per share. If they adopted the other method, and repaid £24,188, and reduced the fully-paid shares to £1, then their assets would be reduced to £175,812, which divided amongst 60,000 £1 shares would give £2 18s. 5d. per share, or a profit of £1 18s. 5d. per share, as compared with £1 18s. 7d. per share.

Mr. J. Neale said that before criticising the proposal, he wished to complain of the meeting having been postponed five months, and then held in a holiday week. The result was that there were only six shareholders present.

Mr. W. G. Sharpe asked if he understood that the holders of the fully-paid £5 shares were to get £4 back, and then to have the liability of £4 per share remaining.

The Chairman said at present there were 54,000 shares which carried a liability of £4 per share, and 6,000 odd shares fully paid up. They proposed to repay £4 per share on the 6,000 odd shares, and leave all the shares £1 paid with a £4 liability.

Mr. Sharpe said he thought the £24,000 proposed to be devoted, as the Chairman had explained, ought to be divided as a bonus amongst the shareholders, and then the £4 should be called up. The company could only exist about another two years.

The Chairman said with regard to Mr. Neale's complaint, he supposed he meant that the accounts were made up to December 31st, but of course it took time to prepare the balance-sheet. Last year the meeting was held on May 6th, and the delay this year was due to the consideration of the matter before them.

Mr. Neale considered the explanation a poor one, and asked if they were going on discussing such an important matter with six shareholders present.

The Chairman said that last year when they held the meeting in Birmingham there were only 10 shareholders present.

Mr. Earouche: We had not such an important matter to discuss.

The Chairman said it seemed it was not important enough for people to come.

Mr. Earouche asked who held the shares with the liability.

The Chairman said they were closely held by a few people.

Mr. Neale said when the company was formed the shareholders had the option of leaving their money in the company and taking £5 fully-paid shares, and 6,047 elected to do so, and the result was that the Canadians, who bought the old company, took the balance of the shares. £1 paid was a liability of £4, but the liability had never been a liability. The Canadian company had promised to spent about a million of money in Birmingham if they succeeded in getting the leases, but they did not succeed, and consequently the money was not required. Then the British Electric Traction Co. came on the scene and took the £1 shares from the Canadian company, and took control of the matter. If the B.E.T. Co. had felt that it was a real liability they could have altered the matter at once. The B.E.T. Co. thought they could get the leases from the Corporation, but they failed. He wanted to know why the 6,000 shareholders who had paid £30,000 at the beginning of the company, and whose money had provided the profits, should now be asked to take back £4 a share, when before long this £200,000 of assets would be divisible. He did not agree with Mr. Cunningham's figures, and he thought it a great hardship that the fully-paid shareholders should be penalised.

Mr. Icke considered the proposal the unfairest which could be perpetrated. He felt that the board might have cancelled the liability on the non-fully paid shares. If the resolution was carried he wished to know whether they would be paid their proportion of profits up to the time of the repayment.

Mr. Neale moved: "That out of the accumulated profits of the company the sum of £4 per share be paid to the holders of the 6,047 fully-paid ordinary shares, and also that a like amount, viz., £24,188, be paid to the £1 shareholders of the company by way of reduction of capital, free of income-tax, pursuant to Sec. 40 of the Companies' (Consolidation) Act, 1908."

The Chairman said Mr. Neale's speech was directed to one point, but the amendment was different to everything he had said in the speech.

The Solicitor said the amendment was clearly out of order.

Mr. Earouche asked if the board had considered what the effect on the shares would be when they carried a £4 liability.

The Chairman: Is your suggestion that the present shares of £5 should be divided into five shares of £1 each?

Mr Earouche: Yes.

The Chairman said no doubt the fully-paid shareholders would like to get it, as it would increase their share in the company by five times.

Mr. Earouche said he could not see it.

The Chairman said he thought the misundertaking arose from the idea that the amount of assets divisible would be paid in proportion to the amount paid up, but that was not so. It would be in proportion to the shares. If Mr. Earouche held one £5 share, his proportion would be that of one share, but he was kindly suggesting that he should have five shares. They could not do that. The whole of the discussion was based on the assumption of "let us keep what we have, although it is unfair to do so." Not one of them had considered the position of the £1 paid shareholder and the unfairness of the present position as regarded him. Mr. Neale as a preference shareholder would object to the liability being cancelled.

Mr. Neale: Have you ever given him the opportunity?

The Chairman said they knew that the preference shareholder was entitled to object, and would object. The suggestion to cancel the liability was not a practical proposal, and as he had before said, the only alternative to the resolution was to call up £240,000 without knowing how to deal with it.

Mr. Earouche: But the company will only exist for 12 months.

The Chairman said that was a mistake, for they had a lot of properties yet to deal with.

Mr. Mackintyre asked whether the £4 to be repaid should not carry a dividend up to the time it was repaid.

The Chairman said that was a fair point, and the board authorised him to say that if the resolution was carried they would declare an interim dividend at the rate of 10 per cent. per annum, which would cover the time till the money was repaid.

Mr. Cunningham pointed out that there was the confirmatory meeting to be held on June 8th, when any shareholder could be present.

On the motion being put 7 voted for the resolution (including the board), and 5 against, and it was declared carried.

Mr. Neale said this would not be the end of the matter as the £5 paid shareholders would not rest under such a resolution. He would like to know how many of those voting held £5 shares.

The Chairman: We will give the information at the next meeting. I think you happen to know because you were chairman of the company.

The meeting then terminated, having lasted an hour and a quarter.

Calcutta Electric Supply Corporation, Ltd.

The annual meeting of this company was held on the 19th inst., at Salisbury House, London Wall, under the presidency of Mr. Edmund Boulnois.

In proposing the adoption of the report (see Electrical Review, page 797), the Chairman said he felt sure the shareholders would have read the report and accounts with much satisfaction. During the year £59,193 had been expended on capital, bringing up the total to £721,705 to the end of the year. The principal item included in the expenditure of 1909 was £42,500 for extensions of mains, which, of course, mean more business and more profit. The total length of mains at the end of 1909 was nearly 255 miles. An additional 500-kw. set, underfed stoker, and coal-measuring apparatus had been installed at Emambagh Lane Station, and more pumps at the Alipore Station. It was satisfactory to report that the relaying of the feeders was now complete. The cost incurred during 1909 (£21,306) had been charged to the renewals account. The whole of this feeder relaying appeared to have been carried out in an excellent manner, and there had not been a single fault discovered in the work. The increase in the number of consumers during the year was 682, compared with 675 the increase in the preceding year, and the equivalent number of lamp connections increased by 73,437, compared with 57,972 in 1908. The demand for current for power purposes, mentioned at last year's meeting, had increased considerably since then, thus opening a new field for the employment of the company's electrical energy. In face of this demand in the Northern district of Calcutta, it was imperative that the company should take steps to supply current, particularly as the jute mill owners, they were informed, were considering a proposal to combine and establish their own plant. As stated at the last meeting the engineers advised the erection and equipment of a high-tension generating station at Cossipore, and in order to obtain the capital necessary for the large outlay which this station would entail, the board issued a prospectus in July last, inviting subscriptions for the remainder of the preference share capital. Up to date 40,350 of the new shares had been subscribed for and allotted. Before embarking on the large capital outlay required for this new station, the board considered that they ought to get independent advice, and they consulted the engineer who was consulted by the board on the first contract entered into by the company on its formation, viz., Sir Alexander Kennedy. Before Sir Alexander Kennedy could advise on this question, he decided that his partner, Mr. B. M. Jenkin, must proceed to Calcutta and investigate the state of affairs on the spot. Mr. Jenkin was for some weeks in Calcutta, and had now returned. He approved the proposal to erect the new station: the details, however, were not yet worked out. He thought it would be advisable to carry out the work gradually, spreading the expenditure over a series of years, and the board confidently believed that an economical and comprehensive scheme would be the result. Meanwhile, to meet the immediate and pressing demand, Mr. Jenkin advised that the company should at once place additional plant in the Ultadangha station, sufficient not only to meet the urgent demand, but also to provide for further requirements for some time to come. The question as to the propriety of the same firm acting both as

consulting engineers, advising on capital expenditure, and as contractors employed to carry out the work, had seriously engaged the attention of the board, and they had decided to appoint Sir Alexander Kennedy consulting engineer to the company. Looking at the importance of the company, and its increasing responsibilities, he felt sure the shareholders would approve this step. At the same time, the late consulting engineers and contractors, Messrs. Crompton & Co., who had rendered excellent service to the company since its inception, would still have the opportunity of carrying out such work as the board might entrust to them from time to time. The revenue had increased by nearly £12,300 over the revenue of the previous year. An increase was found practically under every heading of the account, excepting only the rentals received from fans. This was attributed, in a great measure, to the fact that the consumers had been gradually buying their own fans, and consequently the rentals received were reduced. On the other side of the revenue account, the costs incurred, £60,551, compared with £57,099 last year, an increase of about £3,500. It would be remembered that there was an increased sale of over a million units of current during the year, and if the items of costs were examined it would be found that the generation costs, notwithstanding the large increase of current, were only about £240 up. Coal, the principal item under this head, showed an actual reduction in the amount expended, as well as a reduction in the cost per unit sold, and, having regard to the excellent contracts which had been made, and which would come into full effect during the current year, the board expected to be able to show further reductions. The distribution costs had naturally increased. Management expenses, on the other hand, which showed a reduction in 1908 of £2,500 compared with the management costs, under the agents, in the preceding year, again showed a further reduction in 1909 of nearly £1,000. Under the heading of "Special charges" was an item, "Cost of preparing estimates for town lighting scheme, £1,691 17s." This called for some explanation. The municipality of the city of Calcutta invited tenders for the lighting of the whole of the streets of Calcutta, a city covering a very large area (some 300 miles of streets), and in order to prepare the estimate it was necessary to send out a special expert engineer, who, with his assistants, was engaged a very long time preparing plans, estimates, and a complete report dealing with the important subject of properly lighting a city like Calcutta. The cost appeared large perhaps, but when it was investigated, and the amount of work entailed was considered, it would probably be admitted that the item was a reasonable one. Unfortunately, up to the present, no advantage had been gained by this outlay. The municipality at first decided to continue their lighting by gas. Since then the matter had been further considered, and it was understood that the municipality had decided to light about six miles of the streets, as a tentative measure, by electricity, so that the company might expect to get some benefit later on for the outlay incurred. As a net result of the year's working, after providing and paying the dividend on preference shares, paying income-tax in India and in England, there was a balance, at the end of the year, of £46,134, with which they had to deal. The board proposed to place £17,000 out of the profits to depreciation and renewals account. This was £2,000 more than last year, but as the account had been brought down considerably by the amounts written off for renewals of mains and stood in the balance-sheet at only £19,416, the directors desired to bring this fund up to a more satisfactory level, and no doubt the shareholders would agree with the directors that, with the growth of the company's business, the amounts set aside for depreciation must be gradually increased. He thought they would admit that the position of the company was a most satisfactory one, and that everything pointed to continued success in the future.

Mr. A. M. H. Walrond seconded the motion.

Col. Filgate congratulated the board upon the satisfactory report, which he said was the best ever put before the shareholders. He also inquired whether the municipality had any intention of erecting a lighting station of their own.

The Chairman said they had no knowledge that the Calcutta municipality intended to erect their own power station, although, of course, they had the power to do so. He was sure the company could supply them cheaper. The board still had times of anxiety, as was only natural, but nothing like they had in the past. They now had complete control, and they knew exactly what they were doing from mail to mail. As to increasing the dividend, they would be delighted if the profits would allow of a bigger dividend in the future.

The report was then adopted.

Imperial Tramways Co., Ltd.

The directors' report to December 31st last states as follows:—

Middlesbrough, Stockton and Thornaby Electric Tramways.—The gross receipts from this undertaking amounted to £49,670, as compared with £50,905 for the previous year, a decrease of £1,235. The number of passengers carried was 9,834,213 against 10,014,056 last year, a decrease of 179,843. The net profit for the year is £16,142, as compared with £16,872 for the corresponding period. The decrease in the traffic receipts is due entirely to the unfortunate weather conditions which prevailed throughout the year.

Corris Railway Company.—The receipts in this undertaking are again in sympathy with the adverse condition of the North Wales slate trade, although the greater portion of the decrease is attributable to the loss of tourist traffic consequent upon last year's unfavourable weather.

London United Tramways, Ltd.—A reprint of the directors' report and statement of accounts of this undertaking is appended for the information of the shareholders of the Imperial Co. It will be seen that unfavourable traffic conditions and competition are apparently accountable for the serious decrease of some £30,000 in the gross receipts, and that the directors consider it essential to make provision from reserves for extensive renewals of the permanent way and rolling stock. These circumstances combine to prevent the company from making any distribution of preference dividend for the past year. The accumulated arrears on the Imperial Co.'s holding of 44,446 preference shares of the London United Co. now amount to 6¼ per cent. and represent in total £27,778.

General.—The directors regret that by the non-receipt of any income whatever from the London United investment, the Imperial Co.'s revenue account for the year suffered depletion to the extent of £21,111 and that they are consequently precluded from recommending any dividend on this company's preference and ordinary shares. The net revenue account for the year shows an available amount of £16,747, and after payment of interest on the debenture stock for the whole year, amounting to £12,741, there remains a balance of £4,006, which the directors consider it expedient should be carried forward to the current year's account.

Deutsch-Niederlaendische Telegraphen Gesellschaft.

The report of the directors of the German-Dutch Telegraph Co., of Cologne, states that the hope of a revival of trade in the Far East was only fulfilled to a quite moderate extent in 1909. The economic life in China had not yet received the desired impetus, and no greater spirit of enterprise in trade and industry had also been shown in Japan, where the imports of raw materials and manufactures had in particular largely declined. On the other hand, the economic conditions in the Dutch Indies had exhibited a gratifying development which was plainly expressed in the telegraphic traffic. The working of the cables proceeded smoothly, also in 1909 without interruption. The accounts indicate the following figures for the two years:—

	1909.	1908.
Share capital	£350,000	£350,000
Bond ,, ...	324,500	337,500
Net profits..	37,190	38,500
Dividend, per cent.	6¾	6½

The amount provided for maintenance of cables is £10,250, as compared with £10,200 in 1908: the sum of £8,750 is allocated to the cable renewal fund, as against a similar sum in the previous year, and £4,620 to the cable maintenance fund as contrasted with £4,660; depreciation absorbs £2,070, as against £2,000, and £13,700 is devoted to redemption of the cable network, as compared with £13,150 in 1908; whilst £1,000 is placed to reserve for the provision of duplex apparatus, £2 500 to the special reserve fund, and £1,440 to the ordinary reserve fund, these contrasting with £1,500, £2,500 and £1,500 respectively in 1908. A special expenditure of £1,300 was incurred in granting home leave to a large portion of the *personnel* employed in the tropics.

Sao Paulo Tram, Light and Power Co., Ltd.—The directors report that the operations of the company for the year to December 31st show the following results: Gross earnings, $2,439,485; operating expenses and maintenance charges, $846,626; net earnings, $1,592,859; less taxes, &c., $71,986; bond interest, $300,000; and dividends, $978,866; surplus, $242,005; provision for renewals, $150,000; transferred to profit and loss account, $92,005. The above figures show an increase in gross earnings of $152,075, or 6·6 per cent. The net earnings show an increase of $88,499, or 5·9 per cent.

Companies Struck off the Register.—The following companies have been struck off the register, and are accordingly dissolved:—

Aberavon District Tramways Syndicate, Ltd.
Automatic Telephone Co. (1903), Ltd.
British Electric Separating Co., Ltd. (registered April 20th, 1904).
Engineering Times Co., Ltd.
Everyday Electricity Publishing Co., Ltd.
Garoin Renault Electric Cars and Accumulators, Ltd.
Leslie Walker Instantaneous Fire Detector and Fire Indicator Co., Ltd.
Northern Electrical Supply Stores, Ltd.
Reliance Electric Co., Ltd.

Continental.—France.—The report of the Société des Construction Electriques du Nord et de l'Est (Ateliers de Jeumont) for the last financial year shows a profit of £45,516, as compared with only £41,307 in the preceding 12 months.

The balance-sheet of the Société Lyonnaise des Forces Motrices du Rhone of Lyons, for the last financial year shows a net profit of £100,506, as contrasted with only £92,681 in the previous 12 months.

Belgium.—The Antwerp Telephone and Electrical Works Co. reports a profit of £453 for the last financial year.

Switzerland.—La Société Franco-Suisse pour l'Industrie Electrique reports a profit of only £50,681 for the last financial year, as compared with £65,798 in the preceding 12 months.

Germany.—The report of the Felten-und-Guilleaume-Lahmeyer Werke Gesellschaft, of Mulheim, for the last financial year shows a net profit of £203,172, a decrease of £74,962, as contrasted with the preceding 12 months. The dividend is being reduced from 8 to 6 per cent.

The Mix und Genest Telephon und Telegraphenwerke Gesellschaft, of Berlin, reports a net profit of £20,046 for the last financial year, as contrasted with only £6,562 in the preceding 12 months. A dividend at the rate of 3 per cent. is being declared.

MARKET QUOTATIONS.

Wednesday, May 25th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£10	..
a Copper Sulphate	„	£18	..
a Lead, Nitrate	„	£26	..
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %)	„	£11	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£80	..
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	½d. inc.
c „ Tube (brazed)	„	8½d.	½d. inc.
c „ „ (solid drawn)	„	7d.	½d. inc.
c „ Wire, basis	„	6¾d.	¼d. inc.
c Copper Tubes (brazed)	„	8⅝d.	⅝d. inc.
c „ „ (solid drawn	„	8¼d.	⅜d. inc.
g „ Bars (best selected)	per ton	£70	..
g „ Sheet	„	£70	..
g „ Rod	„	£70	..
e „ (Electrolytic) Bars	„	£60	..
e „ „ Sheets	„	£76 5	..
e „ „ Rod	„	£64 15	..
e „ „ H.C. Wire	per lb.	7¾d.	..
f Ebonite Rod	„	6/-	..
f „ Sheet	„	5/6	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	..	..
h India-rubber, Para fine	„	10/-	3d. dec.
l Iron Pig (Cleveland warrants)	per ton	50/-	2d. inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£12 17 6	17/6 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 15	3/- dec.
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/3	..
p „ „ rolled strip & sheet	„	1/3	..
o Platinum	per oz.	123/6	3/6 inc.
e Silicium Bronze Wire	per lb.	8/d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£149 10 to £150 10	10/- inc.
n „ Wire, Nos. 1 to 16	per lb.	1/10	..
p White Anti-friction Metals:— "Ibis" brand	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£26	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p London Phosphor Copper & Bronze Co., Ltd.
r W. F. Dennis & Co.

Sunderland and District Tramways Co., Ltd.—A meeting of the shareholders of this company was called on Thursday last week, to be held at the Great Eastern Hotel. A representative of the ELECTRICAL REVIEW attended to report the proceedings and was informed by the clerk at the entrance to the hall (who was checking the names of the shareholders by a list in his possession) that "the meeting was private," and "had he an order to attend?" Our representative informed him that he was attending not on order, but for the purpose of reporting the proceedings for the information of the readers of the ELECTRICAL REVIEW, and he was then told he could not be admitted. At our representative's request, the clerk went into the room and informed the secretary of the company that he wished to be present, and returned with the answer that the meeting was quite private and no members of the Press would be admitted.

Prospectus.—*The Atlanta Hydro-Electric Power Co., Atlanta, Georgia.*—We have received from this company an advance prospectus offering for subscription $3,000,000 6 per cent. bonds and $1,500,000 stock (bonus).

STOCKS AND SHARES.

Tuesday Evening.

BUSINESS generally has settled down into more normal courses, and the Stock Exchange finds interest reviving in many of its markets. A smart rise in Consols, and a continuance of the strength in Home Rails, have contributed to the establishment of a better tone amongst most investment stocks. A feature in the electrical markets is a further substantial advance in the Deferred stock of the Anglo-American Telegraph Co. The rubber market provided mild excitement by a fairly pronounced decline in the prices of its leading shares.

The rise in Anglo "A" amounts to no less than 3⅜ points on the week, and it is now rumoured that the Anglo-American Company is on the point of concluding, or has already concluded, a satisfactory working agreement with the Commercial Cable Company, whereby the anticipated expense of laying a new Atlantic cable will be saved, and the million pounds reserve fund consequently preserved to the former concern.

Up to the time of writing, the particulars of this deal are "wrop in mistry," but that there is something in it would seem more than probable. Still, it is a little curious that Commercial Cable Debenture should have fallen ½, because such an arrangement as that rumoured would benefit the Commercial Cable Company considerably in the way of saving it expense. Anglo Ordinary rose a point to 62, and the 6 per cent. Preferred at 101 is ½ higher.

This little excitement is about all that has been vouchsafed to the telegraph department during the past few days. Eastern Extensions have again dwindled a little. Westerns and West Indias are neglected. Marconi's shed 7½d.

Telephone securities are in some request, and several issues show modest advances. The chief is 1½ in National Telephone 4 per cent. Debenture, which has put up the price to 101. The Deferred is ½ higher. American Telephone and Telegraph gained 1, and Telephone of Egypt at 101½ is better. New York Telephone 4½ per cent. bonds are steady at 98½. United River Plates went back ½.

Another curious thing about the rise in Anglo-American Deferred is the fact that it has had no beneficial effect upon the shares in the Mackay Companies, the corporation which holds the bulk of the Commercial Cable Common stock. Indeed, Mackay Common has lost the 2 points it gained last week, and the Preferred remains at 79. Other Trust Companies' stocks are unchanged.

A large and comprehensive scheme has been brought forward by the Anglo-Argentine Tramways for the construction of new lines, having for its object the avoidance of such congestion in traffic as is said to exist at present in Buenos Ayres. The scheme involves raising a heavy amount of extra capital. Upon this, both classes of existing shares have given way, the firsts falling ¼ and the seconds $\frac{3}{16}$, although the 4 per cent. Debenture stock keeps steady at 91½. The expenditure upon the proposed new lines seems to be rather in the nature of an experiment, and it is not surprising that some of the shareholders have taken alarm and sold their shares.

Calcutta Trams are ½ lower, and the reaction in British Electric Traction Preference shares goes on, the loss this time being 2s. 6d. Mexico Tramway bonds are ¼ higher again. Rio Fives strengthened to 98¼, the shares keeping at 97.

Home Rails can lay claim to being "the market of the moment," because there is more doing in them than in most other securities. Proprietors of electrical railway stocks, however, will find but cold consolation in a movement which up to the present has affected them comparatively little. Districts and Metropolitans, it is true, have held their good rises of last week, but Central Londons and Citys are without change. East Londons moved up to 3⅛, and Brighton Deferred has been a very strong spot. It is said that the electrification of the main line to Brighton will shortly enter the realm of practical politics, on account of the excellent results achieved by the small part of the system already converted from steam to electricity. There are also reports as to the London and North-Western being ready to move in the matter of electrifying part of its suburban lines, and, if the present Home Railway cheerfulness continues, the opportunity afforded by it to raise capital on reasonable terms is not likely to be neglected by any of the principal companies. Provided that this cheerfulness goes on, there should be useful electrical contracts in the market soon.

As things are now, it has to be admitted that manufacturing issues are none too bright as far as the quotations for their shares go. Willans & Robinson Debenture has been put back 5 points. Henley's shares are ½ lower, but Babcock & Wilcox have gained a similar fraction, and Telegraph Construction Debenture is ½ higher. Castner-Kellners are still unaffected by the increase in the dividend, and British Westinghouse Debenture has come to a halt after its very sharp rise.

The Electricity Supply market begins to take on its usual summer aspect of dullness combined with sagging prices. Westminster Electrics at 8 are 10s. lower, on the consideration, mentioned here a fortnight ago, that the period of Court mourning may prove unfavourable to the companies operating in the West End. Charing Cross and Strand have declined a further 2s. 6d., City Ordinary losing a like sum. River Plates are a shade harder, and rises of a point each have been secured by Edmundson's 4½ per cent. first mortgage Debenture and Mexican Light and Power Preferred stocks.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations May 17th.	Closing Quotations May 24th.	Business done week ended May 24th. 1910. Highest.	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	£6	Nil	Nil	Nil	Nil	3⅜ — 3⅞	3⅜ — 3⅝	..	..	..	Nil.
116,200	Do. do. 5 % Debs., Nos. 1 to 1,350 Red.	£50	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
$255,196,000	American Telephone & Telegraph, Cap. Stock ..	$100	8 %	8 %	8 %	8 %	138 —141	140 —142	..	..	+1½	5 12 8
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 8
558,460	Anglo-American Telegraph	Stock	3½%	3½%	£3 4s.	3⅜%	60 — 62	61 — 63	..	..	+1	5 15 1
3,220,770	Do. do. do. 5 % Pref.	Stock	6 %	6 %	6 %	6 %	101¼—102½	101½ —102½	102½	101⅜	..	5 17 1
3,220,770	Do. do. do. Deferred	Stock	1¾%	1 %	8/-	25/-	20⅜ — 21	21¼ — 21⅝	21⅛	21 5/16	+3⅛	4 19 6
47,795	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	99¼ —101½	100 —102	..	..	+ ⅛	4 18 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7 1/16 — 8 1/16	7 1/16 — 7 3/16	..	..	..	4 18 6
2,449,176	Commercial Cable, Sling. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	85½ — 87½	85 — 87	86½	85½	— ⅛	4 12 0
16,000	Cuba Telegraph	10	5 %	6 %	6 %	6 %	8¼ — 9	8¼ — 9	..	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16½ — 17½	16½ — 17½	..	..	..	5 17 8
13,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	8¼ — 8¾	8¼ — 9⅛	..	..	..	5 3 3
5,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	7⅞ — 8½	7⅞ — 8½	..	..	..	6 1 7
20,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
60,710‡	Direct United States Cable	20	4½%	4½%	4½%	4 %	18½ — 18⅝	18¼ — 18⅜	..	..	..	5 18 6
39,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,300, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	134 —137	133 —136	135½	133½	—1	5 2 11
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%	85 — 87 xd	85 — 87 xd	86⅜	85	..	4 0 6
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103 xd	..	..	..	3 17 8
900,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	12¾ — 13⅜	12¾ — 13¼	13	12⅞	— ⅛	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	100¼	..	..	3 17 8
230,000‡	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	£5	4 %	4 %	4 %	4 %	99½ —101⅛	99½ —101½	99	..	..	3 18 10
181,197	Globe Telegraph and Trust	10	5⅓%	5⅓%	5⅓%	..	10¼ — 11	10¼ — 11	10⅜	10½	..	5 4 7
181,197	Do. do. 6 % Pref.	10	6 %	6 %	6 %	6 %	13¼ — 13⅝	13¼ — 13⅝	13⅜	..	..	4 8 1
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	..	30½ — 31½	30½ — 31½	30½	..	..	5 16 8
5,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	£5	13 %	13 %	13 %	13 %	52½ — 54½	53½ — 54½	54½	..	..	5 16 0
$41,880,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	88 — 93	86 — 91	..	..	—2	4 18 5
$50,000,000	Do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	78 — 80	77 — 80	..	..	— ½	5 0 0
994,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	2⅜ — 2⅞	1½ — 1⅝	13/9	..	—⅛	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	1 — 1	1 — 1	..	..	..	6 0 0
86,492	Do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	⅞ — 1	⅞ — 1	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104 —105½	104 —105½	104½	..	..	5 13 9
5,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	123½ —125½	124 —126	124½	124	+ ½	4 15 8
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅝	10 — 10⅝	10⅛	..	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅝	10 — 10⅝	10⅛	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5½ — 5⅝	5½ — 5⅝	..	..	..	4 10 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97 — 99 xd	97 — 99	98⅞	..	..	3 11 8
1,988,598	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98½—100½	100 —102	100½	99	+1½	3 18 5
179,818	Oriental Telep. and Elec. 1 to 171,604, fully paid ..	1	7 %	8 %	8 %	8 %	1 7/16 — 1 9/16	1 7/16 — 1 11/16	31/10½	..	..	4 14 10
50,000	Do. do. do. 8 % Cum. Pref...	1	6 %	6 %	6 %	6 %	1 3/16 — 1 5/16	1 3/16 — 1 5/16	..	..	..	4 14 9
195,955	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86½ — 88½	87 — 89	..	..	+ ½	4 9 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —100	98½ —100½	88½	..	+ ½	3 18 10
11,889	Reuter's	£	5 %	5 %	5 %	5 %	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100 —102	100½ —102½	..	..	+ ½	4 7 10
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	128 —131 xd	128 —131	..	..	..	4 11 7
120,000	United River Plate Telephone	£5	8 %	8 %	8 %	..	7⅞ — 7⅞	7⅞ — 7⅞	7⅞	7 15/16	..	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	£5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	5⅛	..	— ⅛	4 10 11
30,008	W. Coast of America, 1 to 30,000 & 58,001 to 63,008	£2½	2½%	2½%	2½%	..	1½ — 1⅝ xd	1½ — 1⅝ xd	..	..	..	4 8 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —100	98⅛ —100⅛	99¼	..	+ ⅛	3 19 7
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930.. ..	10	7 %	7 %	7 %	..	13⅜ — 14⅛	13¼ — 14¼	13 3/16	13⅜	..	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	101½	..	..	3 18 3
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	3/- — 7/-	3/- — 7/-	..	..	..	Nil
34,568	Do. do. 6 % Cum. 1st Pref. ..	10	6 %	6 %	6 %	..	8⅜ — 9⅛ xd	8⅜ — 9⅛ xd	8⅛	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref. ..	10	Nil	£2 6	15 %	..	8 — 9	8 — 9	..	..	..	16 12 9
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	101 —103	101 —103	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1s Pref., 1 to 640,000	£5	..	..	..	5 %	4⅜— 4⅞	4¼— 4⅜	92/6	87/6	— ½	5 5 3
500,000	Do. 5 % 2nd Pref., 800, to 1,300,000	£5	..	..	..	5 %	4⅞— 4 1/16	4⅞— 4⅞	90/7½	86/3	— ½	5 12 8
4,466,674	Do. 4 % Deb. Stock	Stock	..	..	..	4 %	4 %	90½— 92	90½ — 92	91½	90⅝	.. 4 7 0
982,887	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	105 —107	105 —107	..	..	..	4 13 6
580,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	24 %	5 — 5⅛	5⅛— 5⅜	5 5/32	5⅛	+ ⅛	4 9 6
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8 xd	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	£	7 %	7 %	Nil	..	..	..	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	£	7 %	7 %	3½%	..	..	..	..	..	..	..
40,100	Do. do. "A" 6 % Cum. Pref. ..	£	6 %	6 %	6 %	..	..	..	..	..	..	..
12,897	Do. do. 4 % Funding Certs. ..	£	4 %	4 %	2 %	..	..	..	..	..	..	..
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	5½%	5½%	5½%	5½%	97 —100	97 —100	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	142 —147	142 —147	145½	..	..	5 8 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	122 —126	122 —126	124	..	..	4 15 3
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	108 —110	108 —111	109	10½	+ ½	4 10 1
388,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
188,801	British Electric Traction	10	Nil	Nil	Nil	..	3/- — 1/2	3/- — 1/2	..	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1¾%	..	3⅜ — 3⅝	3½ — 3⅝	70/-	68/9	— ½	4 0 0
1,478,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	90 — 93	90 — 93	91½	..	..	5 7 6
598,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	66 — 71	66 — 71	18½	..	..	6 6 9
100,000	British Insulated and Helsby Cables	£5	10 %	10 %	10 %	10 %	6¼ — 7	6¼ — 7	..	..	..	7 2 10
100,000	Do. do. 6 % Cum. Pref.	£5	6 %	6 %	6 %	6 %	5⅝ — 6¼	5⅝ — 6¼	..	..	..	4 16 0
800,000	Do. do. 4½ % 1st Mort. Deb. Red...	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
204,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	101 — 104	101 — 104	..	..	..	4 6 7
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	£5	Nil	Nil	Nil	..	3/- — 3 1/8	3/- — 3 1/8	..	..	..	Nil
1,316,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	58 — 61	58 — 61	60⅞	59½	..	6 11 2
50,000	‡Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅝ — 1⅛	⅝ — 1⅛	..	..	..	Nil
60,000	Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 106,731 ..	£	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	£	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
195,000‡	Do. do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	4½%	39 — 44	39 — 44	..	..	..	10 4 6
195,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	25 — 29	25 — 29	..	..	..	15 3 0
187,510	Calcutta Trams, 1 to 187,510	£	8 %	6 %	4½%	4½%	4⅜ — 4⅞	4½ — 4⅝	90/-	..	— ½	4 16 9
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,880..	£5	5 %	5 %	5 %	5 %	4⅜ — 5	4⅜ — 5	..	..	..	5 0 0
850,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	99 —102	98 —101	..	..	..	4 9 1
55,000	Callender's Cable Construction shares	£5	15 %	15 %	15 %	10 %	9⅜ — 10⅜	9⅜ — 10⅜	10⅛	9⅞	..	6 19 6
40,000	Do. do. 5 % Cum. Pref.	£5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	5½	..	..	4 10 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102½—104½	102½—104½	..	..	..	4 6 2
491,922	Cape E. Trams., 1 to 491,922	£1	Nil	Nil	Nil	..	½ — ⅝	½ — ⅝	..	..	..	Nil
450,000	Casimer-Kellner Alkali, 1 to 450,000	£1	8 %	12 %	12½%	12½%	2⅜ — 2⅝	2⅜ — 2⅝	..	..	..	4 7 9
910,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 —107	..	..	..	4 4 1
1,890 690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	71 — 73	71 — 73	72	..	..	4 2 2
654,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 88	8 ½	..	..	4 10 11
654,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	53 — 55	53 — 55	..	..	..	3 12 9
1,480,000	City and South London Railway	Stock	2½%	2½%	1½%	1½%	84 — 85	83½ — 84½	84	..	— ½	5 1 5
85,000	Crompton & Co., Nos. 1 to 85,000	£	5 %	5 %	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(Continued)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909	Closing Quotations May 17th.	Closing Quotations May 24th.	Business done week ended May 24th, 1910. Highest.	Lowest.	Rise + or Fall —	Present Yield per cent.
		*										£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	..	¾ – 1	¾ – 1	..	..	..	6 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1⅛ – 1⅜	1 – 1⅛	20/3	20/-	..	5 6 8
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 –102	99 –102	..	..	..	4 18 8
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 – 14	13 – 14	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½%	2½%	Nil	..	⅞ – ⅞	⅞ – ⅞	..	..	..	Nil
17,189	Do. "A" shares, 01–017,189	5	4½%	2½%	Nil	..	1 – 1⅛	1 – 1⅛	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	65 – 70	65 – 70	..	..	..	5 14 4
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	79 – 82	79 – 82	..	..	..	6 1 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	⅛ – ¼	⅛ – ¼	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1⅝ – 1⅞	1⅝ – 1⅞	..	..	..	9 0 8
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7⅞ – 8⅛	7⅞ – 8⅛	..	..	..	6 1 8
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	82 – 86	82 – 86	..	..	..	4 13 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	3½%	Nil	..	¾ – 1	¾ – 1	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10½ – 10⅝	10½ – 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 – 103½	102 –103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	5 %	15%	15 %	15 %	12 – 12⅝	11⅞ – 12⅝	12½	11⅞	— ⅛	5 18 9
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 – 5⅛	6 – 5⅛	5	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½ –107½	105½ –107½	106½	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works..	10	0 %	10 %	10 %	10 %	14⅝ – 15⅜	14⅝ – 15⅜	15⅜	..	..	6 10 1
37,500	Liverpool Overhead Railway, Ord.	10	Nil	3%	Nil	Nil	⅞ – 1	⅞ – 1	..	..	— ⅛	Nil
10,000	Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5½ – 5⅝	6 – 5⅝	..	..	— ⅛	9 1 10
800,070	London United Trams. (1901), 1 to 60,007	10	3 %	3 %	Nil	..	1⅛ – 2⅛	1⅛ – 2⅛	..	..	..	Nil
392,980	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1⅛ – 2⅛	1⅛ – 2⅛	..	..	..	Nil
195,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3¾%	..	2⅛ – 2⅜	2⅛ – 2⅜	45/-	..	..	13 12 8
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	68 – 72	68 – 72	70½	..	..	5 11 1
5,782,662	Metropolitan Consolidated	100	1 %	1%	1 %	1 %	44 – 44½	44 – 44½	45	44½	..	2 4 11
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	66 – 68	66 – 68	67½	66	..	4 0 11
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	24 – 24⅛	24 – 24⅛	24⅝	24½	— ⅛	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	4½%	..	⅞ – ⅞	⅞ – ⅞	14/1⅛	..	..	5 15 0
814,016	Do. do. Defd.	1	Nil	Nil	Nil	..	⅛ – ¼	⅛ – ¼	1/6	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	⅜ – ⅜	⅜ – ⅜	15/-	..	..	5 19 5
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	97 – 100	97 –100	98½	..	..	4 10 0
$10,822,200	Mexico Trams Co., Common Stock	..	..	..	..	..	130 –132	130 –132	..	..	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	5 %	..	95½ – 96½	96 – 97	96½	95½	+ ½	5 3 1
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	⅛ – ¼	⅛ – ¼	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	¼ – ⅜	¼ – ⅜	12/8	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	82 – 85 xd	82 – 85 xd	..	..	..	5 3 6
87,850	Telegraph Construction and Maintenance	12	5 %	17½%	15 %	17½%	32½ – 34½	32½ – 34½	34	33	..	7 2 10
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 –102	100½ –102½	..	..	+ ½	3 18 1
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	5 %	..	100½ –101½	100½ –101½	101⅜	100⅜	..	4 18 6
2,800,000	Do. do. 4½% Bonds	..	..	..	4½%	4½%	88 – 90	89 – 91	90¼	89	+1	4 18 11
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	38 – 40	38 – 40	38½	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	⅛ – ¼	⅛ – ¼	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 126,001 to 141,666	5	..	6 %	6 %	3 %	1½ – 2½	1½ – 2½	..	..	..	1 4 2
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	65 – 75	60 – 70	65	64	–5	5 14 4

ELECTRICITY SUPPLY COMPANIES.

30,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 30,000	5	10%	10 %	10 %	10 %	7⅜ – 7⅞	7⅜ – 7⅞	..	..	..	6 17 1
9,851	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 – 7⅛	7 – 7⅛	..	..	..	4 18 4
400,000	Central Electric Supply 4 % Gnar. Deb. Stock	100	4 %	4 %	4 %	4 %	100 –103	100 –103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	3¾ – 4⅛	3⅞ – 4⅛	78/9	..	— ⅛	5 17 8
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4¼ – 4⅜	4⅜ – 4⅜	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	3¾ – 4⅛	3⅞ – 4⅛	..	..	..	5 2 10
445,786	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 –100	97 –100	..	..	..	4 0 0
42,486	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3⅞ – 4⅛	3⅞ – 4⅛	75/-	..	..	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	101 –103	101 –103	..	..	..	4 7 5
70,596	City of London Elec. Lighting, Ord. 40,001—110,596	10	6 %	6 %	6 %	7 %	11⅛ – 12	11⅜ – 11⅞	11⅜	..	— ⅛	5 17 11
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 – 13	12 – 13	12⅛	..	..	4 12 4
400,000	Do. 5% Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 –125	121 –125	124	..	..	4 0 0
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	100 –103	100 –103	100¾	100	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1⅛ – 2	1⅛ – 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅝ – 3⅛	2⅝ – 3⅛	..	..	..	7 13 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94 – 96	94 – 96	..	..	..	5 4 2
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅛ – 8	7⅛ – 8	7⅞	7⅝	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅝ – 11⅜	10⅞ – 11⅜	11¼	11⅛	+ ⅛	5 15 8
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	103 –106	103 –106	..	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock	stock	4½%	4½%	4½%	4½%	98 –101	98 –101	99⅜	..	..	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	⅛ – ¼	⅛ – ¼	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	8 %	Nil	Nil	..	1½ – 1⅝	1½ – 1⅝	..	..	..	Nil
480,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	73 – 76	74 – 76	..	..	+ ½	5 18 5
$8,150,000	Electrical Dev.Co.of Ontario, 6% 1stMtg.Gold Bnds.	$500	..	..	5 %	5 %	82 – 85	82 – 85	83¾	..	..	5 17 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½ %	4⅛ – 4⅜	4⅛ – 4⅜	..	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅜ – 5⅛	5 – 5⅛	..	..	+ ½	4 10 11
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	101 –104	101 –104	..	..	..	4 6 7
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	8½%	7 – 7⅛	7 – 7⅛	..	..	..	5 13 4
$1,876,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	102 –104	102 –104	103	..	..	4 16 2
31,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	7 – 7⅛	7 – 7⅛	7	..	..	5 6 8
90,000	Do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94½ – 96½	94½ – 96½	98½	98	..	4 2 11
111,000	London Electric Supply Corporation, Limited, Ord.	8	4 %	2½%	3 %	..	1⅝ – 2	1⅝ – 2	..	..	..	4 8 11
70,000	Do. do. 6 % Pref.	5	6 %	6 %	6 %	..	4⅜ – 5⅛	4⅜ – 5⅛	..	..	..	5 14 3
382,856	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4½%	4 %	4 %	92 – 94	92 – 94	94	93	..	4 5 1
300,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	5 %	3¾ – 4⅛	3¾ – 4⅛	80/-	..	..	5 17 8
76,191	Do. 4½ % Cum. Pref. 1—71,105	5	4½%	4½%	4½%	4½%	4⅛ – 4⅜	4⅛ – 4⅜	..	..	..	4 12 4
225,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	104 –107	104 –107	..	..	..	4 4 1
248,000	Do. 3½ % Mort. Deben. Stock Redem.	stock	3½%	3½%	3½%	3½%	83 – 86	83 – 86	..	..	..	4 1 5
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	84½ – 85½	84½ – 85½	85	..	..	5 16 3
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	3½%	..	79 – 81	79 – 81	80½	79¾	..	4 6 5
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	102 –104	103 –105	104	103¼	+1	6 13 4
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	89⅛ – 90⅜	89⅛ – 90⅜	90¼	89⅛	..	5 10 6
80,000	Midland Electric Corporation, 4½ % 1st Mort. Deb	Stock	4½%	4½%	4½%	4½%	97 – 99	97 – 99	..	..	..	4 10 4
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	2½%	..	4⅛ – 4⅜	4⅛ – 4⅜	..	..	..	2 15 0
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4⅜ – 4⅝	4⅜ – 4⅝	..	..	..	5 2 7
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	5 %	99 –101	99 –101	..	..	..	4 19 0
10,859	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	11⅜ – 12⅜	11⅜ – 12⅜	..	..	..	5 9 10
20,000	Oxford. 1 to 96 and 407 to 20,810	5	7 %	7 %	7 %	7 %	6⅜ – 7	6⅜ – 7	6⅜	..	..	5 0 0
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 190,507	1	2½%	6 %	8 %	2 %	2 – 2⅛	2⅛ – 2⅜	46/3	43/9	+ 1/16	3 17 10
100,000	Do. do. 6% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	6 %	1⅜ – 1⅝ xd	1⅜ – 1⅝	..	..	..	5 4 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 –105	103 –105	..	..	..	4 15 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	8¾ – 9	8¾ – 9	..	..	..	5 14 8
90,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅞ – 7⅛	6⅞ – 7⅛	..	..	..	5 7 8
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	86 – 88	86 – 88	87½	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1⅜ – 2⅛	1⅜ – 2⅛	..	..	..	Nil
85,000	South London Electric Supply, Ord.	4	8 %	4 %	5 %	5 %	2⅞ – 3⅛	2⅞ – 3⅛	..	..	..	6 9 0
180,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	100 –103	101 –104	..	..	+1	3 16 11
140,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	½ – ⅝	½ – ⅝	..	..	..	5 0 0
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 – 1⅛	1 – 1⅛	20/-	..	..	6 4 6
294,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	98 –101	98 –101	99¾	98⅜	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	¾ – 1	¾ – 1	..	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	2 – 2½	2 – 2½	..	..	..	10 0 0
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½ %	4½%	4½%	79 – 81	79 – 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	⅜ – ⅝	⅜ – ⅝	16/-	..	..	5 9 7
100,00	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8½ – 8¾	7⅞ – 8⅛	8⅛	7⅞	— ⅛	5 17 8
51,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 – 5½	5 – 5½	..	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4 per cent., March 17th, 1910.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING APRIL, 1910.

It will be remembered that the March exports reached the record total of £874,327, due to the inclusion of a very large telegraphic export; although the April figures are less imposing, viz., £350,511, yet they include a greater amount of "general" business than in the previous month—the figures for the two months, neglecting telegraphic items, being, March, £252,234; April, £306,033. This latter total is a considerable improvement on anything we have previously recorded, and compares with an average of under £240,000 for "general" business (*i.e.*, exclusive of telegraphic material) during the 12 months of 1909.

Of the various items which contributed to this satisfactory result the machinery section totalling some £145,000 is the most noteworthy; cable exports were also above the normal, amounting to nearly £70,000 in value.

The import total reached £156,211, which compares with £181,530 in March and is below the monthly average of 1909; a marked decline is noticeable in the lamp section, which has been the most prominent among import items for some time.

The re-exports at £22,053 continue at a higher level than in 1909.

Our own trade was well distributed as usual, the Colonies, South America and the Far East absorbing the greater portion of the exports.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Country receiving exports and importing.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric lamps and parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	315	2,736	19	160	12	3,173	33	33	...	3	300	6,784
Germany	70	189	111	179	634	2,976	...	...	...	167	204	4,530
Netherlands	336	965	28	27	9	271	51	3	25	...	...	1,715
Belgium	160	434	320	67	519	1,166	5	4	...	527	78	3,280
France and French Indo-China	1,081	...	607	148	...	2,201	...	12	...	6	179	4,234
Portugal	3	44	3	132	25	151	...	...	...	40	...	398
Spain, Canary Isles and Spanish Africa ...	310	585	106	74	79	4,434	...	29	...	197	135	5,949
Switzerland, Italy and Austria-Hungary ...	336	17	80	48	729	2,229	...	...	25	8	10	3,482
Greece, and Turkey	125	10	10	19	...	505	...	97	...	33	53	882
Channel Isles, Gibraltar, Malta and Cyprus...	105	66	49	329	13	183	15	4	...	...	99	863
U.S.A., Philippines and Hawaii	173	171	31	84	56	648	51	...	375	...	1,082	2 671
Canada	247	7,516	202	427	610	4,924	...	199	...	324	4,519	18 898
British West Indies and British Guiana ...	66	49	...	165	...	916	...	28	12	30	100	1,366
Mexico, Colombia, Panama, San Salvador and Venezuela	6	171	...	558	...	1,678	...	...	...	...	232	2,645
Peru, Uruguay and Bolivia	51	8	37	179	...	432	...	8	130	32	9	886
Chile	47	98	7	182	42	984	...	47	33	762	55	2,257
Brazil	478	240	119	327	1,031	9,086	2,167	156	49	60	12,849	26 562
Argentina	1,246	6,238	313	894	845	14,293	98	527	38	5,551	3 717	33,760
Egypt, Tunis, Morocco and Persia	47	861	82	110	152	823	...	76	...	2	839	2,992
British West Africa and Ascension	97	399	98	...	391	65	...	21	...	83	193	1,347
Rhodesia, O.R.C. and Transvaal	1,742	1,726	18	717	...	24,964	....	321	...	3,326	150	32 964
Cape of Good Hope	987	1,103	71	1,020	18	2,320	856	863	15	94	371	7.718
Natal	993	10,536	18	448	76	3,204	22	114	...	85	329	15,825
Zanzibar, Brit. E. Africa, Mauritius and Aden	53	100	...	45	2	...	...	4	...	12	98	314
Madeira, Portuguese Africa and Azores ...	82	148	...	45	41	142	...	31	...	...	160	649
China and Siam	340	325	821	906	10	1,857	65	31	116	6,897	3,448	14,816
Japan and Korea	281	4,814	87	107	982	10,052	1,247	3	...	4,046	12,248	33,867
Java, Dutch Borneo and Indies	42	...	....	...	...	354	...	...	129	...	120	645
India	3,765	8,055	1,299	3,191	615	21,830	3,186	2,586	492	221	158	45,398
Ceylon	22	605	40	60	71	375	73	39	28	88	150	1,551
Straits Settlements and Fed. Malay States...	150	58	62	120	32	404	569	58	14	66	204	1,737
Hong Kong	618	1,699	11	255	...	177	1,036	12	44	47	...	3,899
West Australia	267	3,326	62	180	206	3 379	...	562	...	356	1,000	9,338
South Australia...	376	379	168	84	...	3,215	64	104	...	312	35	4,737
Victoria	623	8 429	171	901	110	2,853	...	222	...	5,767	...	19,076
New South Wales	2,390	5,472	12	467	506	4,041	301	355	...	5,851	68	20,080
Queensland	147	205	...	56	144	3,277	...	35	...	1,002	104	4,970
Tasmania	...	110	...	...	...	...	...	...	...	183	...	293
New Zealand	405	1,917	474	351	...	906	857	258	87	1,343	535	7,133
Total, £	18,582	69,804	5,536	13,062	7,960	34,488	10,696	6,772	1,612	7,521	44,478	350,511

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Sweden, Norway and Denmark ...	9	...	...	201	...	2,339	5	529	...	11,595	14,678
Germany	577	10,875	1,717	32,083	2,636	19,989	489	509	4,665	14,533	88,023
Netherlands	40	100	...	1,324	20	...	21	...	22	40	1,567
Belgium	576	1,428	77	132	120	604	46	100	833	2,817	6,733
France	10	217	544	3,552	968	112	...	3,080	2,819	710	12,012
Switzerland	532	650	22	290	88	1,468	...	11	56	516	3,633
Italy	...	1,352	...	32	...	340	...	...	...	1,500	3,224
Austria-Hungary	60	990	...	243	...	10	...	14	2,085	...	3,402
Canada	...	200	...	...	...	42	...	...	...	...	242
United States	3,740	...	525	2,129	...	11,727	2,604	141	88	1,283	22,237
Total, £	5,544	15,812	2,885	39,936	3,832	36,631	3,165	4,384	10,568	32,994	155,751

Additional imports: Spain, carbons, £155; India, machinery, £305.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above	£ 2,526	£ 637	£ ...	£ 1,811	£ ...	£ 3,598	£ ...	£ 78	£ 838	£ 12,565	...

TOTAL EXPORTS: £350,511. TOTAL RE-EXPORTS: £22,053. TOTAL IMPORTS: £156,211.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns.

THE LOADING OF TELEPHONE CABLE CIRCUITS.*

By A. W. MARTIN.

(*Concluded from page* 490.)

Although the spacing of the coils in each of the four experiments just described was irregular, the distance variation between air-core and iron-core coils in the respective loops was the same. A very general comparison of results, therefore, may be permitted.

The attenuation constants per mile observed in the above-mentioned experiments (*a*) to (*d*), together with the corresponding calculated values, are summarised in the following Table VIII :—

TABLE VIII.

Average distance between coils. Miles.	Attenuation constant per mile. Air-core coils F. Observed.	Air-core coils F. Calculated.	Iron-core coils 507. Observed.	Iron-core coils 507. Calculated.
1·1	0·0149	0·0141	0·0130	0·0110
2·1	0·0147	0·0147	0·0118	0·0120
3·2	0·0149	0·0160	0·0120	0·0131
4·3	0·0166	0·0172	0·0137	0·0143

From this table and the results and curves (figs. 16 to 19) previously given, it will be seen that with any given spacing the attenuation constant per mile was less for the iron-core than for the air-core coil loaded loops ; or, in other words, the "loudness of speech" received over a given length of the former was greater than that received over an equal length of the latter type of circuit. This result is quite in order, as the iron-core possessed a higher inductance, and offered a lower effective resistance than the air-core coils.

Since coils constructed with solid cores of properly selected magnetic material (so-called iron cores) introduce less resistance into a circuit for a given inductance than do air-core coils, and at the same time transmit speech equally clearly, they are the better type of loading coil. To remove doubt upon this point, compare experiments (*b*) and (*c*). Air-core coils F at 2·1, and iron-core coils 507 at 3·2-mile intervals, make the inductance per mile of loop 0·049 and 0·042 henry respectively ; from which it would appear that coils F spaced 2·1 miles apart should produce slightly better results than type 507 at 3·2-mile intervals. The reverse effect was found in practice, as will be gathered from the results already tabulated.

The observed and calculated results summarised in Table VIII agree within about 9 per cent., except in the case of the 1·1-mile spacing with iron-core coils, where the cable was, no doubt, overloaded. Leaving the 4·3-mile loading out of consideration because of the inferior quality of speech transmitted, and omitting the 1·1-mile spacing for the reason that the loading was too heavy, attention may be confined to the 2·1 and 3·2-mile treatment. As the attenuation constant per mile of unloaded loop was 0·043, it will be seen that the air-core coils produced an increase of about 300, and the iron-core of approximately 370 per cent. in the volume of speech transmitted over equal lengths of circuit. The formulæ employed in the calculations are, therefore, fairly accurate, since they enable the telephone engineer to foretell an improvement of 370 per cent. correctly within 9 per cent. ; and this in the face of very uneven distribution of coils. In passing, it may be noticed that when the coils of either type were close together, the calculated were better than the observed results ; but, as the coils were placed further apart, the observed became better than the calculated attenuation constants. This change-over may be due to the variation between too heavy and too light loading. Taking into account the types of coil available, the cost and the improvement produced, the 3·2-mile spacing is the best in the cable under consideration.

* A paper read before the Institution of Post Office Electrical Engineers on January 11th and February 8th, 1909.

As regards quality of speech transmitted, it will be noted that, in each separate trial (*a*) to (*d*), the iron-core coils proved to be as efficient as those of the air-core form. It has been emphasised that the minimum spacing of coils is such that there will be rather more than π coils per wave-length at 2,000 p.p.s., and that this is so seems to be confirmed by the observations which, for convenience, have been extracted, and are given in Table IX :—

TABLE IX.

Average distance between coils. Miles.	Coils per wave at 2,000 p.p.s. Air-core.	Coils per wave at 2,000 p.p.s. Iron-core.	Grade of articulation.
1·1	6·4	5·6	Very good.
2·1	4·6	4·0	" "
3·2	3·7	3·3	Good.
4·3	3·2	2·3	Bad.

The irregular spacing, no doubt, made the 4·3-mile loading a little worse than it might otherwise have proved from the "quality of speech" point of view ; and in considering these results it should be remembered that the clearness of transmission was judged mainly by comparison with that obtained through equivalent lengths of standard cable. In one other experiment in connection with articulation, the loading coils were so selected and spaced in the loops that all circuits were practically equal in inductance per mile. The results are summarised in Table X. It is scarcely necessary to mention that any one loop was loaded with only one type of coil.

TABLE X.

Coil spacing in miles.	Inductance per mile of circuit including coils. Henries.	Wave length in miles.	No. of coils per wave at 2,000 p.p.s.	Grade of articulation.
2·1	0·134	11·6	5·5	Very good.
3·2	0·132	11·9	3·7	Good.
4·3	0·132	11·9	2·8	Bad.

Note.—Electrostatic capacity = 0·055 m.f. per mile of loop.

The terminal losses observed are shown in Table XI : —

TABLE XI.

Average distance between coils. Miles.	Terminal loss expressed in miles of standard cable. Air-core coils F.	Iron-core coils 507.
1·1	3·0	3·0
2·1	3·7	3·8
3·2	5·4	5·3
4·3	5·6	6·3

The same apparatus was used throughout the trials, but it is interesting to notice that (*a*) the terminal loss with the iron-core was generally greater than with the air-core coils. This is in accordance with the commonly-accepted rule that the greater the inductance placed in circuit, the greater is the terminal loss in apparatus designed for use on unloaded lines ; (*b*) the loss became *greater* with each type of coil as the inductance in the circuit was made *less* by increasing the distance between the loading points. These results are not in agreement with those obtained in the tests upon the 40-lb. conductor cable given in Table II and fig. 15 ; but until more experience has been gained in connection with cables differently loaded, it is not proposed to attempt an explanation of the peculiar variations of "terminal loss."

The loss at the ends of a loaded circuit may be reduced in several ways, typical methods being shown diagrammatically in fig. 20. That denoted by (*a*) is known as "tapering." The central and major portion of the loop is, say, loaded with coils of 100 m.h. inductance, but at each end of the circuit the inductance per coil is reduced, somewhat as shown in the figure. A decrease in terminal loss takes place, but, owing to the fact that the inductance per mile of loop is reduced at the ends, the improvement obtained by loading is not really so great as when all the coils are equally high in inductance. The one effect more or less counterbalances the

other, and, so far as present experience shows, this method is not likely to be used in future. In the arrangement marked (*b*) the whole loop proper is loaded with the same

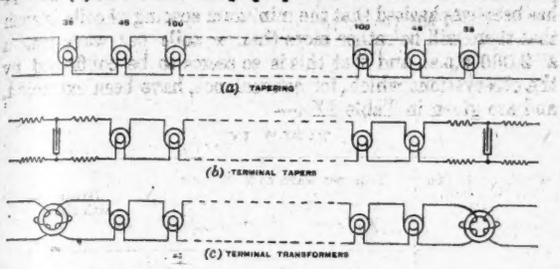


FIG. 20.

type of coil, but is extended at each end by a combination of resistance and capacity virtually comprising an artificial unloaded cable. The extent to which terminal loss is removed by this means depends upon the values of the added resistances and capacities; if they be sufficiently high, all the terminal loss may be removed from the loaded line. No great benefit results, however, for the amount of artificial cable required to remove all the terminal loss has as great a standard cable equivalent as that of the terminal loss itself. Most loaded lines in this country are subject to extension by actual unloaded loops, and terminal loss automatically disappears, but this point is mentioned again a little later on. The method shown by (*c*) in the figure consists of terminating the loaded loop through one coil of a specially designed transformer at each end, the telephone set being joined to the other transformer winding. Such apparatus are capable of appreciably reducing terminal loss, but if not properly designed they introduce as much loss in transformation as they remove from the termination of the loaded circuit, and no net gain results. They may prove of value in cases where telephones have to be fitted direct to the ends of loaded loops, or upon junction lines subject to extension by short subscribers' lines.

There appears to be no necessity for the provision of any special device for reducing terminal loss on lengthy loaded *trunks* at present, for the reason that such circuits are normally subject to extension by other trunks, junction and subscribers' lines, and these are generally, but not always, sufficiently long to eliminate the end loss. The details of one experiment upon terminal loss removal by unloaded extensions are given in Table XII:—

TABLE XII.

Length of loaded loop, miles.	Standard cable equivalent of extensions each end, M.S.C.	Terminal loss, M.S.C.	Type of coil.
77	Nil.	5·4	Air core.
,,	2·0	2·7	,, ,,
,,	4·0	0·9	,, ,,
,,	5·5	Nil.	,, ,,
77	Nil.	5·8	Iron core.
,,	2·0	3·7	,, ,,
,,	4·0	1·9	,, ,,
,,	5·5	1·0	,, ,,
,,	7·0	Nil.	,, ,,

Many experiments have been made upon mixed circuits, *i.e.*, those formed by joining lengths of unloaded aerial or underground line in series with loaded underground loops. So far as measurement by the standard cable method shows, there is no loss due to joining loaded and unloaded lines of any kind in series in any order. As typical cases, consider the following three loops:—

(*a*) An aerial loop measuring 12·6 M.S.C.

(*b*) An underground unloaded loop equivalent to 7·5 M.S.C.

(*c*) A loaded underground loop which, with terminal losses, was equal to 14·8 M.S.C.

The sum of these measurements is 12·6 + 7·5 + 14·8 = 34·9 M.S.C.

The terminal loss on the loaded loop was 5·8 M.S.C.

First, the three lengths were joined in series in the order (*a*), (*c*), (*b*)—*i.e.*, the loaded loop in the middle. The observed standard cable equivalent from either end (*a*) or (*b*) was 29 miles, or a reduction of 5·9 M.S.C. on the sum of the equivalents of the parts. This merely means that the terminal loss on the loaded length was wiped out, and 29 M.S.C. represents the true equivalent of the combination. Secondly, the same lengths were arranged in the order (*a*), (*b*), (*c*), *i.e.*, the loaded loop at one end. The measured equivalent from the aerial end (*a*) was 29 M.S.C. as before, but that from the loaded end (*c*) was 31·9 M.S.C. The latter value is high because of the terminal loss at the end of (*c*).

In all of the hundreds of cases taken, it has been found that, *excluding terminal loss on loaded lines*, the standard cable equivalent of any number of different loops joined in series in any order is equal to the sum of the equivalents of the parts measured separately. This is of some importance, but particularly in connection with the measurement of the standard cable equivalents of differently designed unloaded loops between the same towns, for, letting three such loops be A, B and C respectively, suppose—

A + B = 15 M.S.C.
B + C = 19 ,,
A + C = 12 ,,

then 2 (A + B + C) = 46 ,,

A + B + C = 23 M.S.C., and by subtracting the observed values, the equivalent of each loop may be found.

Before leaving the subject of underground loading by coils, it may be of interest to note one effort which was made to determine what ill effect resulted from the irregular spacing of the inductances in the trials, results of which were given in Table VI and fig. 18. Two special loops were arranged, one to include the most irregular portions of the loading, the other to embrace the most regular. For equal lengths of circuit containing the same number of coils the standard cable equivalents were found to be 25·8 and 24·2 miles respectively. There was thus a loss of about 6·5 per cent. in transmission efficiency, due to the greater irregularity of the loading in the one loop as compared with that in the other. When it is considered that the more irregular of the two circuits thus made up did not differ in its want of symmetry from the more evenly loaded loop by an amount equal to that by which the normal spacing differs from perfect regularity, it will be agreed that 10 per cent. is not too high an estimate of the loss of efficiency due to the normal irregular spacing. It is important that the loading points should be spaced regularly, at least within 5 per cent.

A coil may be regarded as loading a length of the loop equal to half the normal spacing on each side of it. From this point of view, the spacing of inductance coils should be such that the first and last are at a distance from the cable ends equal to half that between any other two coils. This procedure has the advantage that, should two similarly loaded loops be joined in series, the spacing throughout is kept uniform. It also ensures that the terminal loss shall not be abnormal, for it is found that the nearer the first and last coils are to the ends of the circuit, the greater is such loss. The half-normal spacing lengths at each end, in fact, act as small terminal tapers when speaking takes place over the loaded loop only.

Conductors Insulated with Gutta-percha.—Some writers have expressed doubt as to the applicability of the ordinary formulæ for loaded paper-insulated cable circuits to loops insulated with gutta-percha. With the object of determining whether such doubt was justified, a practical trial was arranged upon loops, each conductor of which weighed 40 lb. per mile nominally, had an average overall diameter of 50 mils, and was covered with gutta-percha to a mean overall diameter of 176 mils. The electrical constants of these unloaded loops were:—

Conductor resistance per mile of loop ...	44 ohms.
Electrostatic capacity	0·001 henry.
Inductance	0·13 mfd.

A total length of 105 miles of loop, made up of seven 15-mile sections, was arranged, and each 15-mile section measured as nearly as possible 16 miles of standard cable. The attenuation constant per mile of unloaded loop was, therefore:—

$$0{\cdot}103 \times 16/15 = 0{\cdot}11.$$

By calculation from the ordinary formula for unloaded lines the same value is obtained.

In loading these loops, air-core coils having an inductance of 0·083 henry, and offering an effective resistance of 13·4 ohms at 750 p.p.s., were placed in circuit at 1·5-mile intervals. The gutta-percha wire was placed in tanks and covered with water, but the coils were kept dry, because the coil-cases were not watertight. The standard cable equivalents observed after loading were as follows :—

15	miles of	loaded	loop	... ...	13·0 M.S C.
30	"	"	...	...	19·0 "
45	"	"	...	...	25·3 "
60	"	"	...	...	31·6 "
75	"	"	...	...	37·4 "
90	"	"	...	...	43·3 "
105	"	"	...	...	49·6 "

These results are shown graphically in fig. 21.

From the preceding figures, or the curve, it will be found that each 15 miles of loaded loop is as nearly as possible equal to 6·1 miles of standard cable, so that the observed attenuation constant per mile is $6{\cdot}1 \times 0{\cdot}103/15 = 0{\cdot}042$ nearly. By calculation, using the formula for air-core coils, the value $\beta = 0{\cdot}043$, nearly, is obtained. It therefore

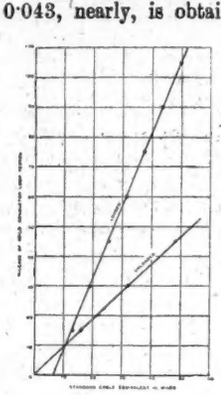


FIG. 21.

appears that the formulæ are applicable whether the insulating material be paper or gutta-percha, but it should be noted that these results were obtained with the gutta-percha wire submerged. When the water was drained off, and the wire allowed to dry, very variable results were obtained, no doubt due to the well-known facts that the effective insulation resistance of gutta-percha-covered wire, when dry, is itself variable, and lower in value than when immersed in water. Another interesting point in connection with these experiments is that 45 miles of the loop used had an insulation resistance of about 1 megohm per mile, while a second equal length had an insulation resistance of over 500 megohms per mile. A direct comparison between these lengths did not reveal any difference in telephone transmission efficiency.

Continuous Loading.—This, as previously mentioned, is generally effected by covering each conductor of the loop with one or more layers of finely-drawn iron wire. So far as is known, no practical experience of this type of loading actual circuits has yet been obtained in this country, but laboratory tests have been made upon short lengths. In one experiment three equally long lengths were made up in the following manner :—

1. Each conductor of solid copper, 79 mils in diameter, and weighing 100 lb. per mile. Wires merely insulated with paper to a given diameter.

2. Each conductor similar to those in (1), but covered with three closely-wound layers of No. 16 S.W.G. annealed iron wire, and then insulated with paper to the same dimensions as the loop mentioned in (1).

3. Each conductor consisted of a strand of seven copper wires, the strand weighing 100 lb. per mile, covered with three closely-wound layers of iron wire, and insulated as in the preceding case (2).

The general result of the experiment was to show (*a*) that at 1,000 p.p.s. the effective resistance of the iron-covered solid copper was 90 per cent., and of the iron-covered strand 64 per cent. greater than that of the untreated loop; (*b*) that the electrostatic capacity of the iron wound loops was roughly twice as great as that of the untreated loop; (*c*) that the inductance per mile of the iron-covered loops was 0·0414 henry, while that of the untreated loop was only 0·0012.

The increase in the resistance with frequency is serious, but, of course, the capacity might be reduced by increasing the overall diameter of the insulation. In all probability the iron wire used in the experiments was somewhat too thick, so that no great notice will be taken of the results obtained. Calculation showed that the attenuation constant per mile of the iron-wound solid copper conductor loop was half that of the untreated circuit, *i.e.*, the iron wire produced an improvement of 100 per cent., and its use may, therefore, be considered in any case where the fitting of inductance coils is impossible. It is not believed that the present known methods of continuous loading can ever be made as efficient as coil loading, for the reason that so much more iron is required to obtain a given increase in inductance in the loop, and the iron is not used to its best advantage. Finally, the cost of iron-covering such wires is high, and they take up much more space than ordinary loops.

Some details of continuously loaded cables laid abroad have appeared in various periodicals, but from what can be deduced from the figures given, it would appear that much of the efficiency claimed results from low conductor resistance and capacity, and not from the presence of the iron windings over the conductor.* It is, however, hoped that further information will be available shortly, when, perhaps, a further paper may be contributed on the subject.

PROCEEDINGS OF INSTITUTIONS.

Depreciation.

By MAJOR W. A. J. O'MEARA, C.M.G.

(*Abstract of paper read before the* INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS, *April 4th*, 1910.)

THE paper relates to depreciation, more particularly in connection with the telephone business.

Depreciation has been defined as a "lessening in value from age and contributory causes," and it may be said to be that deterioration or fall in value of physical property which is not made good by current repairs.

Depreciation can well be considered as having two aspects, namely, the engineering aspect and the accounting aspect. These two aspects, however, are intimately associated, since the provision made under the second named is determined almost wholly by considerations arising out of the first named.

Engineering Aspect.—The principal considerations affecting the question of replacement of machinery and plant and the buildings in which they are housed, are as follows:—(1) Physical decay. (2) Obsolescence, sometimes called antiquation. (3) Inadequacy. (4) Tenure of holding. (5) Reconstruction requirements imposed by legislation. (6) Unforeseen expenditure arising from accidents or other emergency.

The enumeration of these factors which are involved in the determination of the "life" which shall be assigned to physical property of various kinds in order that proper provision may be made in the accounts of an undertaking to meet the charges in respect of depreciation, demonstrates, to some extent, the great complexity of the problem presented to the engineer who has to prepare estimates dealing with this important subject.

Physical Decay.—It is well known that buildings, machinery and plant, however well they may be constructed and cared for, gradually deteriorate so that ultimately they must be replaced, hence the necessity for providing against depreciation has been universally admitted so far as it concerns the factor of physical decay, and at one time this deterioration was thought to be the only item which had to be taken into consideration in assessing the "life" of machinery, &c. In the case of land, on the completion of a development study the acquisition of a site for the central station equipment is the first matter which has to be considered. It is necessary to establish telephone exchange buildings as near as possible to a certain theoretical centre, and unfortunately, however careful may have been the study on which the fundamental plan was based, it is known that telephone business is apt to develop in an erratic manner in some localities. When this is the case, the exchange building is no longer situated in the position which is most economical from the point of view of the provision of external plant, and in consequence the land value deteriorates, not only because the location of a site has not always the same economic aspects in other undertakings as in a telephone enterprise, but also

* Since this paper was read, telephone transmission tests have been made on actual continuously loaded loops of considerable length; the improvement due to the iron was found to be 60 per cent. for large conductors, but no doubt 100 per cent. increase in speaking distance might be obtained upon loops made up of smaller copper wires.

since the buildings thereon may have to be removed at considerable cost to render the site free for the undertaking which it is proposed shall replace the telephone exchange. Land is liable to further deterioration from causes apart from the character of the business carried thereon. The character of the land on which buildings are erected is a factor which in some cases may have considerable influence in the estimation of their "life." This land may be freehold or leasehold. The nature of the servitudes, if any, on the site, and the duration of the lease and the terms under which it is held are naturally factors which will play a determining part in the engineer's calculations. Further, the character of a building is an important factor in fixing its prospective "life." Again, the durability of buildings will depend largely on the character of the periodical repairs which may be carried out.

What I have said in respect of the effect in the value of land, owing to the shifting of the economic centre, applies equally to the value of telephone buildings. However, in both cases, in certain circumstances, instead of a lessening in the value, an actual appreciation in value may accrue to both the site and the building.

The causes affecting the full "life" period of plant and machinery are more numerous than in the case of buildings. There is the inevitable wear and tear resulting from the operation of the plant or machine; further, negligence and incompetence naturally accelerate the rate at which deterioration takes place. For instance, the "life" of accumulators is largely dependent on the care which is exercised in charging and discharging them. In other classes of plant under the expression "wear and tear" have to be included not only the destructive forces which come into play owing to the actual user, but also those external forces which contribute to the destruction of certain classes of property. Take the cases of subterranean and aerial cables, and poles; in both these cases, clearly the external forces are more potent than those arising from the "duty" imposed by the user of the plant; that is, the factors usually referred to as wear and tear.

The most correct estimates of the average "life" of the various classes of plant involved in any undertaking can best be secured by means of statistics. Depreciation is to some extent dependent upon the character of the day-to-day maintenance which has been provided, but it should not be forgotten that the local conditions also play an important part. The chief requirement in order that an engineer may be properly assisted in this matter, clearly consists in the preparation of a carefully compiled record in which the various descriptions of machinery and plant are properly classified. Such a record should show the causes for which any machinery, plant, &c., has been put out of service, the period during which they were in use, and a statement of local conditions likely to have affected their life.

Obsolescence.—The first of the "contributory causes" of depreciation—namely, obsolescence, or antiquation—is a factor of much moment in an undertaking such as the telephone enterprise, particularly in the present stage of its development, when the art is rapidly changing owing to the progress of invention.

The substitution of new and up to-date machinery and appliances for old plant cannot always take place only at such times as the management of a concern can justify the change, owing to the economies which it is hoped to effect by the abandonment of old plant in favour of newer designs. Another influence prevails. It must be remembered that the public nowadays soon learn that much more convenient service may be afforded by some new invention, and they at once commence to clamour for its introduction. Few administrations can withstand the pressure of the public when the convenience of the latter is seriously affected, and the result is that often before the natural "life" of old plant is exhausted, the newer design has to be substituted. During my stay in America, I learnt that frequently it was due to such pressure alone that common battery systems had replaced magneto installations. We have not reached finality in the design of switch equipments; auto-manual and automatic equipments are on the market, and must be taken into consideration in estimating the "life" of telephone apparatus.

Inadequacy.—The item affecting depreciation which is most difficult to cover by an estimate is that of inadequacy; it is largely governed by the original fundamental plan or lay out, which in its turn is dependent on the development study. In the case of a telephone undertaking, not only the rate of growth of the subscribers, but also their distribution may have been inaccurately predicted. It has already been stated that one effect of this is the disturbance of the economic centre; unfortunately, the mischief does not end here, but other results may be that the switchboard equipment is housed in buildings which cannot provide for efficient development at the higher rate demanded by the public requirements. It may also become necessary to replace overhead distribution immediately by means of an underground system, owing to insufficient carrying capacity having been provided in the original pole lines, and in some cases cables may have to be withdrawn within a few months of being laid to be replaced by others containing larger numbers of conductors. Electric lighting undertakings suffer from the same difficulty in connection with the design of their distribution system. The post office engineer is unfortunately also liable to the same errors as prophets in other fields.

Tenure of Holding.—It is quite a common practice to install switchboards in a rented building; in such cases it is the term of the lease, and not the character of the equipment which may determine the "life" of this plant. Further, it is unfortunately necessary at times to place external plant, both underground and open, on private property under a wayleave agreement containing a removal clause; and here again the plant may have to be disturbed, with consequent loss, before the expiration of its natural or even useful "life." If the cases of removal due to these causes are carefully recorded, it will not be difficult to make a fairly satisfactory allowance for such disturbance in estimating depreciation.

Reconstruction Requirements Imposed by Legislation.—It sometimes happens that reconstruction of plant has to be carried out by its owners owing to the exercise of statutory powers conferred on public authorities and corporations. I have in mind such cases as the disturbance of pole and pipe lines by the widening and regrading of streets by city authorities and by the widening of railways, reconstruction of sidings and stations, &c. The burden thrown on the Post Office by the alterations to railway works has been particularly heavy.

Unforeseen Expenditure.—I now come to the last of the factors mentioned as requiring consideration in connection with the replacement of machinery and plant, namely, unforeseen expenditure arising from accident or other emergency. I am inclined to agree with those engineers who hold the view that any replacements on a considerable scale rendered necessary in such circumstances should really be provided for by means of an insurance fund or by payment of annual premiums to an insurance company. Annual sums set aside for this purpose would, of course, form a part of the working costs, and they should be debited as headquarter charges. Consequently, this item need not be included in the appraisal of "lives" of machinery and plant.

Estimates.—The foregoing cursory investigation indicates that, if estimates relating to depreciation are to be tolerably reliable, the machinery or plant should be scheduled under a sufficient number of distinct classes, for admittedly, all the factors mentioned do not affect every type of machinery or plant in the same degree.

In an undertaking which has been in existence for a considerable number of years and which comprises fairly large quantities of plant of the various descriptions required for its conduct, carefully kept records relating to such a plant will afford a secure starting point for the appraisal of the "lives" of various classes of machinery and apparatus employed in the undertaking under consideration, and they will give fairly accurate information concerning the average "lives" of certain classes of plant, the replacement of the greater proportion of which has arisen solely on account of physical decay. Such "lives" may be considered to be the maxima for these classes. In order to estimate the useful commercial "life" it becomes necessary to make deductions from the foregoing maxima in respect of those factors which particularly affect the depreciation of any class of plant. The approximation of the deductions to the true value will depend not only on the extent and quality of the experience of the engineer responsible for the estimate, but on the possession by him of early and accurate information of the nature of the progress inventors are making in the design of new plant, and of a correct appreciation of the real importance of the improvements foreshadowed.

I have prepared a table (Appendix I) showing the estimated years of life which have been assigned to certain classes of plant. It is possible that an explanation for the divergence of views may be found in some or all of the following considerations:—

1. Engineers do not yet work to standard specifications; for example, tin is not contained in the lead covering of all aerial cables; again, in some cases petroleum jelly is employed as a lubricant when lead-covered cables are being drawn into ducts, and in other cases no lubricant is used. The absence of tin or the addition of 3 per cent. of this metal in the lead-sheathing of an aerial cable really determines whether the "life" of the cable will be a comparatively short one or long one.

In the case of underground cables, the use of petroleum jelly has actually proved to be a protective agent against chemical attack, and in consequence cables treated with this substance have a longer average "life" than those which are not so treated. Each engineer naturally relies on his own experience and records for his estimates, and the foregoing statements disclose grounds for different "life" values being assigned to classes of plants which, though generally considered similar, are really dissimilar.

2. Since machinery and plant of similar types are not generally exactly similar in all respects, it follows that the character of the day-to-day maintenance in connection with their operation also varies. This appears to be particularly the case in connection with telephone enterprises.

3. In determining "lives" the same factors (*i.e.*, obsolescence, inadequacy, &c.) are not always included, nor are the same values attached to those factors which have been included in the calculations.

4. Not only do views vary on the policy to be adopted in discarding obsolescent plant, which is largely a question of the temperament of the responsible officials, but, as already stated, the extent of knowledge regarding improvements in progress and the experience and judgment of different engineers naturally vary considerably, and hence the personal equation of the responsible engineer has considerable influence on the completed estimate.

The price obtained from the sale of machinery or plant when put out of service is, of course, available to pay some part of the cost of replacement. In consequence, it is customary to estimate the probable value that machinery and plant will have at the end of their useful commercial "life" in order that the sums set aside for replacement, may be suitably reduced in amount so as to provide as nearly as possible the actual cost of the replacement. The prices obtained for old material at sales held over a considerable period will in the case of the majority of plant in use, readily enable an engineer to arrive approximately at the average percentage values on cost price, which should be allowed for the various classes of "scrap."

Accounting Aspect.—When the engineer has settled the basis on which the proper allowances for depreciation can be provided in the most effective manner, the first question which has to be

considered is the method by which the determined amount for depreciation shall be made available, when renewals become necessary. This is almost entirely an accounting matter.

It may be well to explain that accountants usually apply the term "depreciation" to represent "the amount which has to be charged against the profit and loss account in respect of any class of wasting or perishable assets, before the real profit from an accountancy point of view is arrived at."

In the case of a long-established railway corporation owning hundreds of miles of track and large quantities of rolling stock, depreciation is cared for year by year by the replacement annually of a suitable number of locomotives, wagons, &c., and also by the renewal annually of portions of the permanent way, storehouses, station buildings, &c.

In the past, the Post Office has in respect of the renewal of the telegraph and telephone systems, practically followed a plan very similar to that adopted by railway companies; the sums expended for this purpose were formerly merged with the account for day-to-day maintenance, but in recent times a special sub-head of the vote has been introduced to which renewal expenditure is charged.

Further, in connection with the Post Office telephone business, the Postmaster-General renders a financial statement in order to indicate the commercial results obtained. On examination of this statement, it will be observed that amounts expended in respect of depreciation are separately recorded.

In addition to the methods for dealing with depreciation mentioned above, others are also to be found. In fact, Prof. Dicksee has mentioned that he has himself found six methods in vogue for writing off depreciation, namely:—

1. Charging each year with the actual cost of repairs and small renewals and an equal fraction of the original cost of the asset.

2. Charging each year with repairs and small renewals and with a percentage for depreciation calculated at such a rate as to reduce it to its then realisable value by the time it becomes useless for revenue earning purposes.

3. By estimating in advance the total sum chargeable against revenue for repairs, partial renewals and original cost and charging each year an equal portion of it.

4. By charging revenue with such sum as will at the expiration of the life of the asset write off the original cost thereof, plus interest on the capital from time to time invested therein.

5. By charging revenue each year with actual or average expenditure upon repairs and small renewals, and with such further sum set aside and invested at compound interest as will accumulate to the original cost of the asset at the expiration of its estimated life.

6. Charging revenue with the difference between the book value of the asset and its actual value at the present time, as estimated by an expert valuer.

The conditions affecting various classes of undertakings differ so widely that it certainly cannot be asserted that any one of the methods for dealing with depreciation is the best. It is sometimes the case that, during periods of depression, the temptation to divert sums which should be provided for depreciation to other purposes is very strong, and in consequence, the method adopted should be one in which the risks arising from the starving of the depreciation reserve are not likely to affect the commercial soundness of the undertaking. The really important matter is not the scientific correctness of the records in the company's account books, but the necessity of having cash available at the moment it is required to pay for replacements which may have become necessary. This requirement points to the necessity of forming a "depreciation reserve," and renders it undesirable to employ funds set aside for this purpose in the undertaking itself; rather is it desirable that such funds should be invested in easily realisable securities.

It will doubtless occur to you that, in those cases in which services have to be provided under contracts for stated periods, there is some advantage in making provision for depreciation on a basis which involves equal annual payments, as the rates to be charged, which are naturally a function of the annual expenditure incurred in providing the service, can thus be readily calculated. Methods 1 and 5 are both equally satisfactory from this point of view, and in consequence are eminently suitable for adoption in connection with telephone undertakings and similar enterprises.

Before leaving the accounting aspect of the subject, it may be well to draw attention to the fact that so far as it relates to the statements of accounts, depreciation affects both capital and revenue, since depreciation gradually reduces the value of wasting assets, and the revenue or the Profit and Loss account has to provide the amounts by which the wasting assets are written down in value. It is evident that cases must occur in which the plant retired from service has a capital value which differs from that of the plant which replaces it. This necessitates the adoption of measures for adjusting the Capital Account. One method proposed for bringing about such adjustments consists in the establishment of three separate accounts under the designations of "Plant account," "Depreciation reserve" and "Plant deductions." The manner in which transactions would affect such accounts is perhaps sufficiently indicated in Appendix II.

The object of the various methods of calculating depreciation is to represent the real value of the material part of machinery and plant by means of records in accounts instead of by a process of revaluation by an expert.

It has been asserted that greater accuracy in determining the value of "wasting assets" would be obtained by periodic valuations, and writing off such loss as these valuations show, than by a mere process of book-keeping. The principle of such periodical valuations has been accepted in America, and also to some extent in this country, and there certainly appear to be some advantages in adopting this method of treatment. One of these advantages, but not the least, is that a useful check is established for comparing the actual with the estimated depreciation in any case.

When such valuations are part of a system, and are carried out by independent experts at regularly recurring intervals, another of the advantages is that opportunities will be afforded to adjust the provisions made for depreciation in those cases in which insufficient allowance may have been made for the influence of some of the more variable factors which affect the situation.

Conclusion.— It is generally accepted that often it is on the rate provided for depreciation alone, that the fortunes of an undertaking may turn in deciding whether a profit or loss is being made at every period of its existence. The duty of the engineer is concerned not only with the design of works, but also with their operation and commercial value, and, therefore, his advice will often decide the fortunes of an engineering enterprise.

In every important phase in the development and progress of such enterprises the engineer is faced with the problem of depreciation; he is further much concerned with the exact method of providing for depreciation. If a wrong choice is made, money is absolutely wasted.

The problem confronts him from the earliest days of the inception of an engineering project, and matures when competitive tenders for the work first come under consideration. We know that it is not the capital cost alone which determines whether one scheme is more advantageous than another; a comparison of total annual costs in respect of the tenders received is necessary to enable an engineer to decide which scheme is the more profitable one to adopt, but annual costs are made up of interest on capital, of depreciation and of operative or running costs. As regards any particular tender, the interest on capital and the operative costs are together a constant quantity. The method of allowing for depreciation may, however, vary, and it will, therefore, be seen that according as Method 1, Method 5, or some other method is adopted to complete the figures for the comparison of tenders in respect of two alternative schemes, the annual balance may turn in favour of one tender or another. The engineer is not always in a position to dismiss the question of depreciation from his thoughts, when it has been finally decided that some particular tender for plant or machinery required for his purpose is the most advantageous one, and when in consequence that tender has been accepted. It has already been stated that allowance will have been made in the engineers' calculations for obsolescence. In many cases his anticipations in respect of this factor will be realised, for the inventor is sure to come to his assistance with improvements and claims. In practice, however, it will often be difficult to decide exactly at what date it will be justifiable to replace plant doing effective service by some new invention which may have been "proved in" as eminently satisfactory on being "tested out." In such cases the engineer has to compare a situation in which he has fairly complete knowledge of the value of the various technical and financial factors requiring consideration, with one in which he cannot with the same certainty attach reliable values to the important elements coming into play in connection with the invention, and, further, the value of apparently efficient plant or machinery to be scrapped is sure to attract considerable attention, and in such cases the charge against the depreciation account will indeed loom large. A bold and courageous policy has often proved advantageous in the past in connection with the handling of obsolescent plant, and it is certain to do so again in the future.

In considering the very important question of turning out good plant in favour of new designs of machinery alleged to be more economical, the problem resolves itself into a consideration of the question whether the difference in annual costs likely to be incurred in respect of the new machinery and the actual annual costs incurred in respect of the existing plant is sufficiently great to pay for the "wastage" or value of the unexpired useful life of such parts and the cost of removing such of it as may be "scrapped." For instance, in the example given in Appendix II, the loss shown under plant deductions will have to be extinguished within a reasonable time after its replacement. In such cases also, clearly depreciation, and the method by which it is provided, may be the ruling factors in the commercial situation.

There is still another aspect of the case, which, although of not such frequent occurrence, is of immense importance, and that is the aspect in connection with the valuation of the property of a "going" concern for the purposes of a purchase. The question of the allowance to be made for depreciation becomes in these cases perhaps more controversial than in any other situation. The engineer advising the purchasing party has a double duty to perform. He has to protect his own client, and at the same time he has always before him the responsibility of being just to the selling party.

The engineering problems relating to a proposal to purchase a "going" concern, for all practical purposes involve considerations similar to those connected with alternative tenders, for it is simply a case of considering annual costs in respect of the "going" concern as compared with such costs in respect of the new plant which would do the same work as well if not better.

The subject of depreciation is of vital importance to shareholders of public undertakings, and it is certainly of no less importance to the public generally, who are to some extent involuntary shareholders in the undertaking which absorbs our energies.

A public utility service managed by a State Department must be not only the best of its kind, but the charges made for it must be reasonable, and such as not to involve a burden on the ordinary taxpayer. Thus we see that ultimately depreciation finds its way into the rate charged for our telephone service, and must react on the same with every change in engineering policy.

APPENDIX I.

TABLE SHOWING DEPRECIATION OF PLANT CONNECTED WITH A LOCAL TELEPHONE SYSTEM AS ASSESSED BY VARIOUS AMERICAN AUTHORITIES.

Property.	Engineer, Manufacturers' Telephone Co.*					Engineers, Chicago Telephone Co.*					Chicago Telephone Commission.*					Another American authority.				
	Further description of property.	Depreciation.					Further description of property.	Depreciation.					Further description of property.	Depreciation.					Further description of property.	Depreciation.			
		Life in years.	Per cent. No interest.†	Scrap value.	Per cent. to reconstruction.‡			Life in years.	Per cent. No interest.†	Scrap value.	Per cent. to reconstruction.‡			Life in years.	Per cent. No interest.†	Scrap value.	Per cent. to reconstruction.‡			Life in years.	Per cent. No interest.†	Scrap value.	Per cent. to reconstruction.
Conduits	All types	50	2	—	}		Main	33	3·3	0	1		Main	50	2·0	0	1½		Main	10	2·0	0	Figures not available.
	—	—	—	—			Subsidiary	14	7·1	0	2		Subsidiary	20	5·0	0	2		Subsidiary	15	6·7	0	
Underground cables	All types	20	5	—	—		Main	16½	3·5	42	2		Main	20	3·0	40	2		Main	20	3·0	40	
	—	—	—	—	—		Subsidiary	12	4·8	42	2		Subsidiary	15	4·0	40	2		Subsidiary	13	4·6	40	
Aerial cables	All types	20	5	—	2¼		—	11	6·0	34	3		—	15	4·0	40	3		—	12	5·8	30	
Poles, including cross-arms ...	—	20	5	—			—	8½	11·8	0	6		—	10	10·0	0	4½		—	10	10·0	0	
Aerial wire, copper	—	—	—	—			—	15	2·0	70	5		—	15	2·0	70	3		—	12	5·0	40	
" iron	—	62	15	—			—	—	—	—	—		—	—	—	—	—		—	8	12·5	0	
" drop wires	—	—	—	—			—	7½	11·7	12½	10		—	8	10·6	15	4		—	10	9·0	10	
Aerial terminals	—	—	—	—			—	12½	8·0	0	8		—	12	8·3	0	3		—	10	10·0	0	
Subscribers' instruments ...	—	10	10	—			—	10	10·0	0	5		—	10	9·5	5	2		—	10	10·0	0	
Private branch exchange boards ...	All types	12½	8	—			—	10	10·0	0	5		—	8	10·0	20	2		—	8	11·3	10	
Central office switchboards ...	All types	12½	8	—			—	7	14·0	2	6		—	8	10·0	20	2		—	8·4	9·9	17	
Buildings	—	20	5	—			—	33	3·3	0	1½		—	40	2·5	0	1		—	24	2·6	38	

* Extracts from Report of Special Telephone Commission, Chicago, 1907. † Ordinary depreciation. ‡ Extraordinary depreciation.

APPENDIX II.—EXAMPLE SHOWING METHOD OF RECORDING TRANSACTIONS RELATING TO REPLACEMENT OF A SWITCHBOARD IN ORDER TO ADJUST CAPITAL ACCOUNT AUTOMATICALLY IN RESPECT OF THE SAME.

PLANT ACCOUNT.

Dr.		Cr.	
Switchboard installed...	£2,000	Switchboard withdrawn	£2,000

DEPRECIATION RESERVE.

Dr.		Cr.	
Unexpired "life" value of switchboard withdrawn	£600	Set aside from current earnings for depreciation on switchboard:	
(Price obtained for "scrap" value of serviceable parts credited to plant deductions)		1st year	£200
		2nd year	200
		3rd year	200
		4th year	200
		5th year	200
		6th year	200
		7th year	200
		Total	1,400

PLANT DEDUCTIONS.

Dr.		Cr.	
Switchboard withdrawn	£2,000	For depreciation reserve	£1,400
Cost of removing board	170	For sale of "scrap" ...	130
		Value of parts again returned to service ...	280
		Loss (current expense)	360
Total ...	£2,170	Total	£2,170

THE ELECTRICAL DRIVING OF A LEAD MILL.

MESSRS. FOSTER, BLACKETT & WILSON, who have for the past 50 years been established at Hebburn-on-Tyne as lead manufacturers, recently decided to equip electrically the whole of their works. The work was entrusted to Messrs. Charles Martin & Co., Newcastle-on-Tyne, the wiring to Messrs. Warren, Beattie & Co., of Middlesbrough, and the complete equipment of motors, auto-starters and controllers to the British Westinghouse Electric and Manufacturing Co., Ltd. The result of last year's running has, we understand, fully justified the decision arrived at.

The raw materials are hauled in trucks by a single-drum haulage running from the company's private jetty on the Tyne. On conversion of the plant, the crankshaft of the vertical double-acting steam engine formerly used was taken out and a gear wheel and countershaft put in, by means of which it is now driven by a 60-H.P. motor operated by a drum controller. In carrying out the conversion,

ELECTRICALLY-DRIVEN THREE-THROW PUMP FOR LEAD PIPE PRESS.

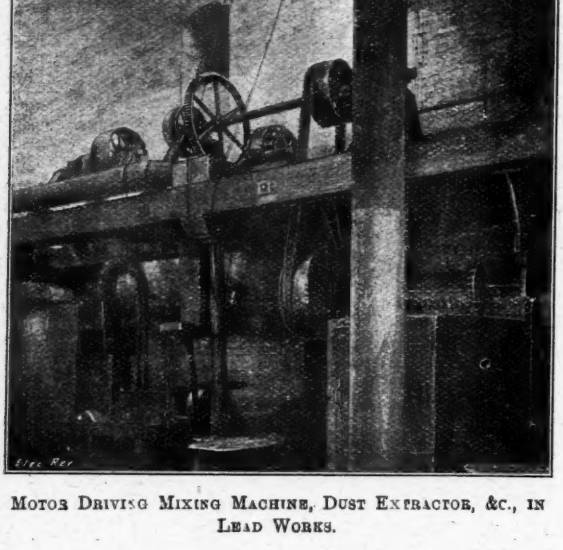
care was taken to avoid delays by using as much as possible of the existing gear. The capital outlay, therefore, was kept down, and is, we are informed, very low for this class of work. The work of conversion was carried out without a shut-down and without any serious hitch in the operation.

In the separating house, the lead pigs are refined and the pure lead is run into a mould about 8 ft. sq., in which a mass of metal, weighing about 8 tons, is formed. This metal slab is lifted by a jib crane, formerly operated by a steam engine. The crankshaft and cylinders of the engine were taken out, a countershaft and

gear wheel put in, and the drive effected by a motor and drum controller.

The lead mill has rolls about 20 in. in diameter and 8 ft. 3 in. long. Six live rolls, standing in series, facilitate the passing of the billets through the mill. The fly-wheel, which weighs 7 tons and has a diameter of 19 ft., was retained for equalising the load on the motor. In contrast to this the motor is almost lost sight of.

The mill was originally driven by an engine of 200 I.H.P., and on conversion the crank was replaced by a gear wheel, and the countershaft carrying the pinion engaging this wheel is now belt driven by a 90-H.P. slip-ring motor. A pair of rolling cutters at each side of bed trim the edges of the sheets when necessary, and also acts as a



Motor Driving Mixing Machine, Dust Extractor, &c., in Lead Works.

guillotine for cutting the sheets into lengths, both of these being operated from the gearing of the mill.

We gather that the electric drive now installed has largely increased the output of the mill, in consequence of the steadier running afforded by it. A three-ton jib crane used for loading the finished lead from the mill has been equipped with a 10-H.P. motor, the motor and controller being mounted on a bracket which swings with the crane. Two pipe presses lie adjacent to the lead mill, each consisting of an hydraulic press forcing the solid lead out of a steel container through a die. A steel core bedded in the container settles the bore of the pipes, which can be made from $\frac{3}{16}$ in. to 9 in. inside diameter, a maximum hydraulic pressure of $3\frac{1}{2}$ tons per square inch being exerted on an 18 in. diameter ram. The fly-wheel of the three-throw plunger pump, formerly steam-driven, has been replaced by a 6-ft. diameter pulley, belt driven by a 30-H.P. slip-ring motor.

In addition to the quiet drive now obtained, there has been considerable improvement in the class of pipes turned out, owing to the even turning movement of the motor.

A group of machinery consisting of a lathe, flue paddles, circular saw and cupola blast fan, formerly driven by an old type engine, is now driven by a 20-H.P. motor. Five overhead electrically-driven *jib* cranes, provided with switches for throwing the motors on and off the mains, are used for loading and unloading the sacks. This is a great improvement on the nine cranes formerly used which were driven through an endless rope drive by a 50-H.P. gas engine.

In two white lead grinding equipments, steam engines have been replaced by 50-H.P. motors driving the existing shafts through a belt and a 10 to 1 gear reduction; two large Torrance mixing machines for converting the white lead into white paint are driven by a 60 H.P. motor, geared to the old shafting. This motor also works a 1-ton hoist, an oil pump and a dust extractor. The grinding plant is driven by a 50-H.P. motor geared to the original shafting. On account of the danger which might occur from heavy overloads, a large-faced ammeter is placed in front of the operator with a danger line indicating the overload point.

A dust extractor fan and a mixing and sifting machine are driven by a 10-H.P. motor, also a Sturtevant fan about 3 ft. in diameter running at 900 R.P.M. which is used to avoid dust in the packing rooms, is driven by a 5-H.P. motor. Loose sheet iron covers fixed over the motors and suspended by pulleys from the cross beams protect the motors from dust.

METHODS OF GOVERNING STEAM TURBINES.

[COMMUNICATED.]

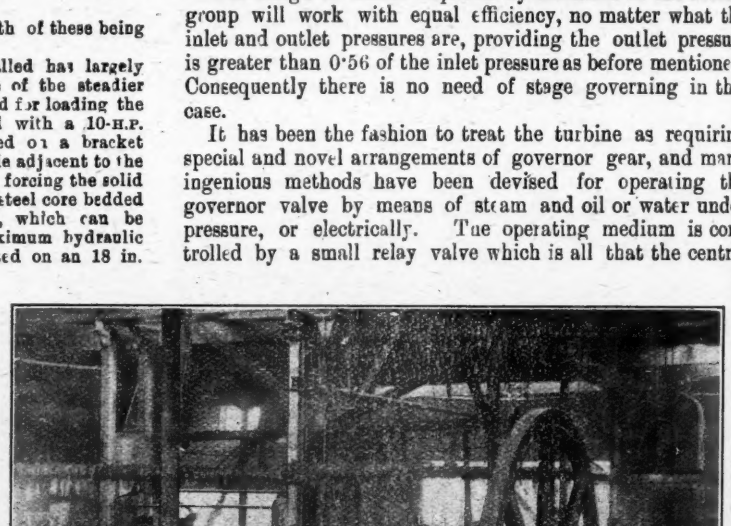
All types and designs of steam turbines can be divided into one of two groups for the purpose of governing. All designs in which the steam pressure on the outlet side of the nozzle does not exceed 0·56 of the pressure on the inlet side belong to one group, while those designs in which the outlet pressure is greater than this belong to the other group. Theoretically, all designs would give the best steam consumption results if the nozzles were opened and closed singly, and the full steam pressure maintained on the inlet side.

Owing to the comparatively small number of nozzles required by designs in the first group it is possible to do this, so that only one nozzle is working with throttled pressure steam at any time, but the large number of nozzles required by designs in the second group make this impracticable, so that a single valve has to be accepted, which throttles the steam pressure to all the nozzles at the same time. Prof. Stodola and others have shown that the design of nozzle required by machines in the first group—namely, expanding—only works at maximum efficiency with the inlet and outlet pressures for which it has been correctly designed, and that any change in this respect causes considerable loss due to internal losses in the jet itself.

Consequently to attain the best results it is necessary to alter the number of nozzles in action at each successive stage right through the turbine, so that the same pressure is maintained in each stage at all loads. To do this automatically, however, is impracticable, so that usually only the first stage is controlled by the governor, and hand-operated valves are provided for the following stages, by means of which groups of nozzles can be cut out when it is desired to run on fractional loads for any length of time.

The design of nozzle required by machines in the second group will work with equal efficiency, no matter what the inlet and outlet pressures are, providing the outlet pressure is greater than 0·56 of the inlet pressure as before mentioned. Consequently there is no need of stage governing in this case.

It has been the fashion to treat the turbine as requiring special and novel arrangements of governor gear, and many ingenious methods have been devised for operating the governor valve by means of steam and oil or water under pressure, or electrically. The operating medium is controlled by a small relay valve which is all that the centri-



Lead Rolling Mill; 90-H.P. Driving Motor on the Right.

fugal governor has to move, and consequently enables the governor to be made very sensitive. The weak point in all such systems is due to the liability and tendency of a relay valve and the piston operating the governor valve to stick and also to lag and overrun due to the friction of rest and inertia, unless kept continually on the move. To overcome this the well-known Parsons design introduced a reciprocating motion to a steam-operated governor valve, which keeps the relay and governor valves continually on the beat, and

admits the steam in blasts of varying duration. The governor valve is of the double beat design, and at light load strikes the seat at each beat. Owing to the lift at light loads being small, the daspot is not very effective, so that a good deal of wear and tear takes place. At heavier loads the valve never touches the seat, but simply keeps beating across part of the valve opening, producing a varying throttled pressure, instead of a constant one. At one time it was considered that an improved steam consumption was obtained by the blast system of admission, but as the steam consumption curve follows the Willans "straight-line" law characteristic of all throttling governor valves, there is no gain over the ordinary method, giving a steady admission pressure.

For operating the series of valves on machines in the first group, or for very large machines in the second group requiring a large valve, there are some advantages in the relay system, but for moderate sized machines only requiring a single throttling governor valve, the direct-connected governor and valve as universally used on high-speed steam engines, is decidedly preferable, and is coming more into use. No valid objection can be raised against it, and the only reason why it has not been more widely used is that of fashion. With the exception of the Parsons, all designs have originated abroad, and it is unquestionably a fact that elaborate designs have a great fascination for Continental engineers. The steam consumption result is the same, and no better speed control is possible with one system over the other. On the other hand the relay-operated gear is far more liable to failure, and is dependent on an outside supply of motive power, which in the case of oil and water is again dependent on some other mechanism. From the commercial standpoint the question of cost carries considerable weight, and as competition becomes keener, the simple and cheaper direct-connected design will come more and more into use.

Most turbines have a self-contained oiling system, in which the pump is driven by the turbine through a worm and worm wheel, and the governor is commonly fixed on, or driven by the pump shaft. There is no difficulty, however, in designing a governor to fix on to the turbine shaft and run at the same speed, and in some cases it has been done. This has the advantage of making the governor independent of the operation of gearing, which is a desirable feature.

Owing to the possibly disastrous results which may occur through the running away of a turbine, it is the practice to fit an independent governor which operates a safety cut-off valve when the speed exceeds 10 per cent. above the normal. This governor should always be fixed on the turbine spindle, so that no failure of gearing can affect it. It is usually designed to be very unstable, so that it remains at rest until near the critical speed, and then when it begins to move, the centrifugal force generated rapidly exceeds the spring load and the balls fly out with a hammer blow. This effectively overcomes the friction of rest and inertia in the governor gear and ensures prompt action. The safety governor valve is often combined with the main stop valve. The valve is opened and closed by hand in the usual manner, but should the safety governor come into operation, a lever is tripped, and the valve is closed automatically by springs or a steam-operated piston.

This necessarily complicates the mechanism, and as the safety valve is never needed except as a last resource in dire necessity, it is better kept independent. Any trouble with the valve puts both automatic and hand control out of action and involves a dash to the boiler stop valve. For the same reason the governor gear is far better made positive, and not dependent on any outside motive power, with the complications of relay valve and operating piston. It should also be so designed that it can easily and quickly be tested by hand when starting up the turbine. It is so rarely used in actual work that, unless systematically tested, it may be found out of order on the rare occasion when its services are needed.

Electrical Fatality.—Our correspondent writes that a fatality occurred on March 26th at the Brakpan station of the Victoria Falls Power Co. A man named Jackson, whilst working on a pole, came in contact with a live wire and received a shock, from which he died almost immediately.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Proposed New Japanese Tariff.

The following is a statement of the rates at present leviable on electrical and simi ar materials in Japan and the rates under the proposed new Tariff recently issued by the Japanese Government. It is probable that the new Tariff will come into force in July, 1911.

	Present Tariff. Yens per 100 kin.	Proposed Tariff. Yens per 100 kin.
Iron wire:		
Not coated with metals:		
(*a*) Not exceeding 1·5 mm. in diameter	(See below.)	0·95
(*b*) Other...		0·80
Coated with base metals:		
Galvanised:		
(*a*) Not exceeding 1·5 mm. in diameter		1·35
(*b*) Other		1·20
Tinned		20 % ad val.
Other		20 % ad val.
Wire and small rod, not exceeding ¼ in. in diameter:		
Of iron and mild steel ...	0·503	—
Of steel (other than mild steel)	1·819	—
Telegraph or galvanised wire:		
Of iron and mild steel ...	0·253	—
All other telegraph wire ...	5 % ad val.	—
Copper plates and sheets	11	9·95
Copper wire:		
Not coated with metals:		
Not exceeding ·5 mm. diam. ...	11·20	13·10
Other		9·50
Coated with base metals		14·20
Copper wires, twisted	11·20	25 % ad val.
Brass plates and sheets	7·40	8·30
„ wire	7·40	9·90
Materials for railway construction, not otherwise provided for:		
(1) Rails	0·129 5 % ad val	0·80
(2) Portable rails	25 % ad val.	1·30
(3) Turntables and parts thereof	25 % ad val.	2·35
(4) Fish-plates, tie-plates, and sleepers	1·20	1·10
(5) Other	25 % ad val.	25 % ad val.
Posts and other materials for suspending electric lines, not otherwise provided for:		
(1) Posts and parts thereof ...	25 % ad val.	1·85
(2) Other: (A) Of iron		4·35
(B) Other		14·00
Insulated electric wires:		
(1) Armoured with metals:		
(A) Submarine telegraphic or telephonic cables	5 % ad val.	free
(B) Other:	20 % ad val.	
(*a*) Combined with india-rubber or gutta-percha...		9·40
(*b*) Other		4·70
(2) Other:		
(A) Flexible cords:		
(*a*) Combined with silk ...	5 % ad val.	20 % ad val.
(*b*) Other	20 % ad val.	15·10
(B) Other:		
(*a*) Combined with india rubber or gutta-percha...		13·00
(*b*) Other		20 % ad val.
Chain belting for machinery ...	not specified	20 % ad val.
Call bells and alarm bells for vehicles	46·30	44
Radiators: Of cast-iron	30 % ad val.	0·55
Other		40 % ad val.
Copper, brass or bronze manufactures not specified:		
Coated with base metals	30·80	40 % ad val.
Other		48
Amperemeters and voltmeters ...	20 % ad val.	62·50
Wattmeters	20 % ad val.	39·90
Dynamometers	20 % ad val.	20 % ad val.
Electric batteries: Accumulators ...	20 % ad val.	20 % ad val.
Dry batteries ...		13·80
Other		25 % ad val.
Parts of electric batteries excluding carbons for electrical use:		
Electrodes	not specified.	20 % ad val.
Other		25 % ad val.
Telegraphic and telephonic instruments and parts thereof not otherwise provided for... ...	20 % ad val.	20 % ad val.
Railway carriages and other vehicles, running on rails, not otherwise provided for	(See below)	30 % ad val.
Railway carriages for passengers ...	5 % ad val.	—

(To be continued.)

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

11,379. "Automatic electric apparatus for setting the hands of a clock or clocks either backwards or forwards at will." S. D. Neill. May 9th.

11,415. "Improvements in metallic-filaments for electric lamps." I. Kitsee. May 9th. (Complete.)

11,419. "New or improved process for silvering glass and the like, especially applicable to internal reflectors for metal-filament electric lamps." J. Meszaros. May 9th.

11,429. "Improvements in the apparatus for starting and controlling electric motors for organ blowing or other purposes." B. Young. May 9th.

11,437. "Improvements in and relating to the actuation of controllers for electric machinery particularly applicable to electric traction." H. B. van Daalen. (Application for Patent of Addition to No. 15,203, of 1909.) May 9th. (Complete.)

11,439. "Improvements in means for controlling electric motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) May 9th. (Complete.)

11,466. "Improvements relating to the electroplating of metal surfaces." F. J. Keegan and Dunlop Pneumatic Tyre Co., Ltd. May 9th.

11,479. "Improvements in devices for automatically igniting and controlling gas." L. G. Bartlett. (Date applied for under Sec. 91 of the Act, May 11th, 1909, being date of application in United States.) May 9th. (Complete.)

11,494. "Improvements in electric clocks." E. J. Reid. May 9th.

11,559. "Improvements in stage arc lamps." W. Walters. May 10th.

11,562. "Improved sanitary apparatus for use in connection with telephone mouthpieces." A. White. May 10th. (Complete.)

11,564. "Improvements relating to electric switches." C. H. Pearson. May 10th.

11,569. "Improved and detachable power handle for use on electrical controllers on tramcars, motor-cars, trains, and the like." R. Chadwick and C. Clarke. May 10th.

11,581. "Improvements in or relating to a method of working arc lamps in series with incandescent lamps." A. Heimann and W. Schaffer. (Applications for Patent of Addition to No. 747, of 1910. Date applied for under Sec. 91 of the Act, August 2nd, 1909, being date of application in Germany.) May 10th. (Complete.)

11,582. "Improvements in or relating to a method of working arc lamps and incandescent lamps in common with an alternating current circuit." A. Heimann and W. Schaffer. (Application for Patent of Addition to No. 748, of 1910.) (Date applied for under Sec. 91 of the Act, November 10th, 1909, being date of application in Germany.) May 10th. (Complete.)

11,583. "Improvements in or relating to a method of working arc lamps and incandescent lamps in common on an alternating-current circuit." A. Heimann and W. Schaffer. (Application for Patent of Addition to No. 748, of 1910.) (Date applied for under Sec. 91 of the Act, January 10th, 1910, being date of application in Germany.) (Complete.)

11,600. "Improvements in terminals for electric cables." Firm Robert Bosch. (Date applied for under Sec. 91 of the Act, July 23rd, 1909, being date of application in Germany.) May 10th. (Complete.)

11,602. "Improvements in telephone transmitters and relays." R. A. Fessenden. May 10th.

11,614. "Improvements in alternating-current magnets." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) May 10th. (Complete.)

11,636. "Improvements relating to telephonic apparatus." E. A. Graham. May 10th. (Complete.)

11,644. "Improvements in electric lighting of motor vehicles." W. J. Fahn. May 11th.

11,658. "Improvements in guiding apparatus for electric trolley-wheels for tramways and the like." H. G. Atkinson. May 11th.

11,667. "Improvements in electric cables for burglar alarm systems." J. P. Williams. May 11th. (Complete.)

11,693. "Improvements in or relating to the electrolysis of liquids." J. Billiter. (Date applied for under Sec. 91 of the Act, July 12th, 1909, being date of application in Austria.) May 11th. (Complete.)

11,707. "Improvements in and relating to electric switch mechanism." British Thomson-Houston Co., Ltd., and E. B. Wedmore. May 11th.

11,708. "Improvements in and relating to electric switches." British Thomson-Houston Co., Ltd. (Gen. Elec. Co., United States.) May 11th.

11,716. "Improvements in electric furnaces." J. Thomson. (Date applied for under Sec. 91 of the Act, May 13th, 1909, being date of application in United States.) May 12th. (Complete.)

11,717. "Improvements in electric furnaces." J. Thompson and F. A. J. FitzGerald. (Date applied for under Sec. 91 of the Act, May 13th, 1909, being date of application in United States.) May 11th. (Complete.)

11,718. "Improvements in electric furnaces." F. A. J. FitzGerald. (Date applied for under Sec. 91 of the Act, May 13th, 1909, being date of application in United States.) May 11th. (Complete.)

11,746. "Improvements connected with electric lamp or like switches." W. L. Kernan. May 12th.

11,747. "Safety device for locking incandescent electric lamp attachments." G. H. Ide. May 12th.

11,756. "Improvements in and relating to or connected with electrical circuit breakers, fuse bridges, cut-outs, distribution boards and the like." H. K. de Lacey. May 12th.

11,761. "Improvements in electrical warp stop motions for looms for weaving." C. Klein. May 12th. (Complete.)

11,781. "Improvements in or relating to electrical accumulators." P. K. Stern. (Date applied for under Sec. 91 of the Act, May 12th, 1909, being date of application in United States.) May 12th. (Complete.)

11,792. "Improved electric cable." C. J. Beaver, G. W. L. Preece and E. A. Claremont. May 12th.

11,830. "Improvements in or relating to controllers for dynamo-electric machines." T. von Zweigbergk. May 12th. (Complete.)

11,837. "Improvements in and relating to depolarising agents for electric batteries." A. T. K. Estelle. (Date applied for under Sec. 91 of the Act, May 13th, 1909, being date of application in Sweden.) May 12th. (Complete.)

11,854. "Improved mode of controlling electric lights and in apparatus therefor." R. J. Aiken. May 13th.

11,896. "Improvements in or relating to the armature windings of dynamo-electric machines." Siemens Bros. Dynamo Works, Ltd., and B. G. Pickering. May 13th. (Complete.)

11,903. "Improvements in the art of signalling by electromagnetic waves." R. A. Fessenden. (Date applied for under Sec. 91 of the Act, May 18th, 1909, being date of application in United States). May 13th. (Complete.)

11,904. "Improvements in controllers for alternating-current electric motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) May 13th. (Complete.)

11,931. "Incandescent electric lamps." A. F. F. Stodd. May 13th. (Complete.)

11,939. "Process for the extraction of magnesia from magnetic rocks." G. Molesere. May 14th. (Complete.)

11,951. "Electrical impedance switches and regulators." H. J. Herberts. May 13th.

11,978. "Improvements in armouring for electric wires or cables." C. A. Vandervell. May 14th.

12,026. "Improvements relating to the control of electric motors." Adams Mnfg. Co., Ltd. (Cutler-Hammer Mnfg. Co., United States.) May 14th.

12,029. "Improved drive for petrol electric vehicles." W. A. Stevens. May 14th.

12,059. "Improvements in direct-producing continuous-current dynamos and motors." E. Grote. May 14th.

12,060. "Electrode for electro-medical purposes." G. Jahr. May 14th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Distribution of Electric Energy, and Cables therefor. A. E. Tanner and E. A. Claremont. 27,858. December 22nd. (Post-dated April 8th, 1909.)

1909.

Fixings for Making Attachments to Walls or Ceilings for Electrical Conductors, Picture Hooks and the like. J. J. Rawlings, H. W. Handcock and A. H. Dykes. 5,891. March 11th.

Method of and Apparatus for Producing Indications by Received Electro-magnetic Waves. R. A. Fessenden. 6,008. March 12th.

Rapid "Make and Break" Electrical Switch Movements. J. Stevenson and O. R. Williams. 8,620. April 10th.

Mechanism in Quick "Make and Break" Electrical Switches. H. Rose. 8,692. April 13th.

Electric Distribution Systems. British Thomson-Houston Co., Wedmore and Whitcher. 8,979. April 15th.

Electric Incandescent Metal or other Filament Lamps. S. Horvath. 9,318. April 20th.

Electric Candle Lamp. H. Rawlings. 10,288. April 30th.

Production of Electric Currents. B. Schwerin. 10,793. May 6th. (Date applied for under International Convention, May 7th, 1908.)

Electric Current Distributors. J. Pinson. 11,413. May 14th.

Electric Fuse Carriers. R. Hatry. 11,954. May 20th.

Toys and Models Driven by Electric Motors. J. S. Parker. 12,063. May 21st.

Burglar-Alarm Systems. A. Sundheimer. 13,955. June 14th.

Magnetic Compasses for use with Sketching Boards. S. Dousmani. 14,719. June 23rd.

Trolley Heads of Electric Tramcars. E. H. Cockshott. 15,147. June 29th.

Electrically-Driven Centrifugal Fans. Alldays & Onions Pneumatic Engineering Co. and E. L. Joselin. 16,476. July 15th.

Telephone Transmitters. M. Gottschalk. 17,868. July 22th.

Sparking or Ignition Plugs for Gas, Petroleum or other Explosion Engines. E. A. H. de Poorter. 19,682. August 19th.

Enclosed Electric Fuse Indicators. British Thomson-Houston Co. (General Electric Co.) 19,209. August 20th.

Electric Switches. E. Lundsteen & Aktieselskabet International Elektrisk Trappeautomat. 19,826. August 30th.

Regulation of Load Equalisers for Electric Supply Systems. British Thomson-Houston Co. (General Electric Co.) 20,055. September 1st.

1910.

Relays for Telephone or other Weak-Current Apparatus. C. Stille. 65. January 1st.

Bearings for the Spindles of Electric Measuring Instruments. British Thomson-Houston Co. and C. D'Arcy. 2,031. January 26th.

A 70,000-volt Power Transmission in Spain.—The Sociedad Hidroelectrica Espanola has recently opened an important supply station at Molinar, on the Jucar River, from which some 30,000 H.P. is to be transmitted at 66,000 to 70,000 volts to Madrid (153 miles away), Valencia, Cartagena and Alcoy. A flow of 40 cb. metres per second is available with a useful fall of 66·35 metres, and at present three Francis turbines of 7,200 H.P. each at a speed of 428 R.P.M. are installed. They are directly coupled to three-phase generators of 5,625 K.V.A. at 6,600 volts. This voltage is transformed in three three-phase oil transformers of 5,625 K.V.A. each, from 6,600 volts to 67,000 volts. The oil used for cooling these transformers is circulated by means of centrifugal pumps, through cooling tubes placed in tanks, round which water flows. Up to the present two of the transmission lines have been completed. One of these is 153 miles long and leads to Madrid; it consists of six conductors of 50 sq. mm. section. The other leads to Valencia (50 miles), and has six conductors of 35 sq. mm. section. The normal mast spacing is 80 to 100 metres, and the distance between conductors is 1·8 metres. The insulators are supported on pins and are supplied by the three firms of Hermsdorf, Schomburg and Rosenthal. The remaining lines to Alcoy and Cartagena are now under construction. As no faults of any sort have developed in operation, it has been decided to increase the normal voltage to 70,000. The power delivered in Madrid will be largely converted to direct current for traction and private lighting, whilst that in Alcoy and Cartagena is chiefly required for power purposes in the large mines there and for industrial work. The electrical machinery was supplied by the Siemens-Schuckert Werke.—*E.T.Z.*